UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

PROCEEDINGS

OF

SIXTH COTTONSEED PROCESSING CLINIC

AT THE

SOUTHERN REGIONAL RESEARCH LABORATORY

NEW ORLEANS, LOUISIANA

IN COOPERATION WITH

VALLEY OILSEED PROCESSORS' ASSOCIATION, INC.

FEBRUARY 4-5, 1957

F O R E W O R D

These proceedings are a summary of the information presented at the Sixth Cottonseed Processing Clinic held at the Southern Regional Research Laboratory, New Orleans, Louisiana, February 4-5, 1957.

Sponsored jointly by the Southern Regional Research Laboratory and the Valley Oilseed Processors' Association, this working conference was attended by one hundred and nine representatives of cottonseed oil mills, equipment manufacturers, users of cottonseed products, linters dealers, commercial laboratories, industry associations, and federal agencies in addition to staff members of the Southern Laboratory. The program for the first day was arranged by staff members of the Southern Laboratory and for the second day by officials of the Association.

Major attention at the Clinic was focused on the problems of production, marketing and utilization of linters for various end uses; on industry trends and research needs; and on problems and progress in oil mill processing of cottonseed with emphasis on improved product quality.

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Second Day

W E L C O M E

By

C. H. Fisher, Director
Southern Utilization Research and Development Division

Mr. Chairman and friends: We look forward to these meetings year after year and to the pleasure of seeing our colleagues in the industry come back here for a visit. I am very happy again to have the privilege of welcoming you personally and on behalf of the Division to this Clinic. I also wish to thank the Valley Oilseed Processors' Association for the privilege that we have of working in cooperation with them in arranging these Cottonseed Clinics. We are convinced that these Clinics are helpful to us and we hope they are helpful to you, too. I think at least that I should like to express a word of appreciation, also, to each individual member for coming here, taking the time and the trouble to come here to visit us, and to some of you who have come for some distance, in order to witness this meeting. We hope also that this Clinic, like the earlier ones, will be highly successful and that each one of you will enjoy his visit in New Orleans.

I would like to review briefly some of the principal events in the Division during the last twelve months. First, there have been no major organizational changes. We were pleased because we received another increase in funds for research this past year. While this enabled us to increase our research on some of our commodities, the effect was not as much as might have been anticipated from the dollars because of the increasing cost of research.

We are pleased because associations have placed additional fellowships here. We are glad to have these fellowships not only because this enables us to do more research but also because we think this action on the part of industry reflects a feeling of confidence in the Southern Division. We now have a total of eight fellows located here as a part of the fellowship program: The Tung Research & Development League, one; National Cottonseed Products Association, three; National Confectioners' Association, three; and the Canvas Processing Association International, one.

We have continued to do research and to publish results at the rate of approximately 140 papers a year, or almost three scientific papers a week.

It might be of interest to you to know that during the past year the Department of Agriculture conferred the Superior Service Award to our research team that, working in cooperation with industry, developed the filtration-extraction process.

We will soon have Cobalt 60 facilities that will enable us to expand our research on the use of ionizing radiations in connection with our utilization research program. The last twelve months in agricultural research and research planning have been rather very unusual, primarily because the surplus problem in agriculture continues to be serious. Primarily because of the serious surplus problem a number of surveys and studies have been made to look for remedial measures. Probably many of

you know that proposals have been made to increase by a substantial amount research to increase the industrial utilization of farm crops. The Panic Bill was introduced in the House. There were hearings and it is rather interesting that everyone was for this additional research. The President's Commission of five men has appointed task groups to study different commodities and products. These task groups will submit their reports to the Commission, which will issue a report and recommendations for actions that should help solve the surplus problem.

In closing, I would like to express thanks again to the Valley Oilseed Processors' Association and to its officers, Messrs. Patterson and Garner. I'd like also to thank the members of our staff who helped plan and arrange the Clinic, particularly Messrs. Gastrock, Fred Pollard and Ralph Persell.

RESPONSE

By

R. F. Patterson, President
Valley Oilseed Processors' Association
Trenton Cotton Oil Company, Inc.
Trenton, Tennessee

Thank you, Dr. Fisher, for the warm and sincere welcome that you have extended to us this morning, also for those enlightening remarks concerning the work done at this great laboratory. It is a privilege for me, representing this group assembled here, to thank you and your staff for these annual meetings, which you arrange, and also thank you for sharing with us in industry the knowledge gleaned through your efforts and cooperation, on our behalf.

PROGRESS REPORTS ON UTILIZATION OF LINTERS

MAKING THE BEST USE OF LINTERS STANDARDS

PART A

By

M. E. Whitten
USDA, Agricultural Marketing Service
Washington, D. C.

The need for linters and greatly increased production during and following World War I resulted in the establishment of standard grades for this product. With this shift from the condenser to the flue-beater type linters, these standards became outmoded. A survey of the industry in 1952 indicated that: (1) standards should be based on flue type linters; (2) physical standards should be properly graduated for foreign material content, with provision for indicating foreign material content in excess of that represented in the standard grades; (3) physical standards should represent felting grades only; (4) overlapping and subgrades should be eliminated; (5) standards should be made available for grade and staple with these factors reported separately; (6) Far West qualities should be included in the standards; (7) descriptive terms should be used for character rather than sectional designations. The new standards represent qualities found in old standard grades One Low through Five Low and are designated numbers One through Seven.

Linters standards are a useful tool in the control of mill production quality. More extensive use of standards by mills should result in better and more uniform quality linters. Buying and selling on grades

is a practical means of efficient marketing. If standard grades and staples were specified in sales contracts, quality would be established, thereby providing means for arbitration. Standards can be used by the mill in producing desired qualities, by the dealer in securing and selling specific qualities, and by users in the selection of desired qualities. The oil mill operators, linters dealer and felter, or mattress manufacturer, could best be served by the use of a medium which they all understand and which will facilitate an orderly marketing program.

MAKING THE BEST USE OF LINTERS STANDARDS

PART B

By

M. H. Fowler
The Buckeye Cellulose Corp., Cincinnati, Ohio
Cincinnati, Ohio

On July 1, 1956, a new grading system for first-cut cotton linters was promulgated by the Dept. of Agriculture. The new standards which were set up seemed to define very well the characteristics which determine linter value: color, staple, and character.

It is unfortunate for trading purposes that the new system does not correlate closely with the old. Many of us have found it difficult, if not impossible, to translate the new grades into terms familiar to us and, therefore, have been unable to arrive at equitable prices based on the new grades.

Equally troublesome is the fact that we have not yet been able to devise a formula for relating grade to yield, using the new system. This is important to us. We used such formulas (with the old grading system) to predict yields at any grade and at various mills. These predictions helped to control the future sales. The economics of taking high or low first-cuts, especially in times of fluctuating prices, need to be examined frequently. The relation of grade to yield is an important factor in such a study.

For convenience and all-round adaptability, it is hard to improve on a grading system that gives narrow quality steps and uses a "single-figure" grade, as the old system did. We have been forced to continue our trading and manufacture under the old system and we think that is a general experience in the industry.

MAKING THE BEST USE OF LINTERS STANDARDS

PART C

By

T. M. Gluyas
Mississippi Cottonseed Products Company
Jackson, Mississippi

The subject of course relates only to the new standards effective August 1, 1956 when use of the old ones in effect since 1926 were invalidated.

There was probably no subject in the industry that supplied as much conversation between buyers and sellers as did the old standards, and none that has supplied as little as the new ones to date, probably because of their simplification and application to improved methods of production over the years.

The old standards were born in 1925-26 with 7 grades - one through seven, and bred 52 or more - including subgrades, compounds, short compounds, minuses, pluses etc. The new standards are likewise composed of seven grades but without any divisions, except compounds of two, therefore it requires dismissal of the old ones from our minds while making close study of the new for their best use.

This study by the producers first requires proper sampling for determinations of grades most profitable to produce and sell advantageously on different and fluctuating markets. It is equally important to produce uniform qualities within one full grade where possible, as compound grades are priced on the average of the two.

Although the quantity of linters purchased and sold on standard grades is comparatively small, the standards will always serve useful descriptive purposes, as guides in both production and sales. This is especially true since quotations publicized on the standards take into consideration the value of both color grade and staple; whereas, the old ones mostly placed value on color grade only, irrespective of the end use.

PROGRESS IN THE DEVELOPMENT OF IMPROVED SEED CLEANING EQUIPMENT

By

L. L. Holzenthal
Southern Utilization Research and Development Division

The present status of work on the cleaning of cottonseed here at the Southern Regional Research Laboratory can be briefly stated as follows:

Pursuing the principle and belief that, in order to clean cottonseed to a desired degree and at the required input rate, it is necessary to

fully separate the particles from each other and impart to each particle the same high initial velocity, the so-called ARS Differentiator has been devised and is presently under development.

To date, the Differentiator has demonstrated that at feed input rates equivalent to 100 to 200 tons per day, it is possible to --

(a) Remove virtually all very fine particles of foreign material free of seed. This includes sand, dirt, free linters, lint and very fine field trash.

(b) Sort seed in accordance with their quality. The lower quality seed tend to fall nearest the differentiator.

(c) Sort foreign material. In general for the thruput range covered, stems tend to fall in fractions 15 to 45 feet from the differentiator with the maximum at about 30 feet. Boll bases travel from about 30 to 75 feet with a maximum at about 45 feet from the unit. Boll wall fragments travel about 15-45 feet with maximum at almost 20 feet.

(d) Produce fractions of particular compositions and of a more manageable nature for further processing. Occurrence of certain types of foreign material along with seed of more or less definite quality characteristics in certain fractions provides a more definite basis for secondary separation of the components in those fractions than would attempts at preliminary separation of the total feed mixture.

(e) Provides access to highest quality seed with least linters content. These seed could possibly be stored for later processing, or possibly used for planting purposes.

It is quite evident from the above that the product from the Differentiator still contains stems and boll bases in undesirable quantities. To reduce these it was thought desirable to resort to one accessory method to reduce stems, and to one to reduce boll bases; or even more desirable, if possible, to one unit to remove both components.

Thus far we believe we have discovered one accessory method that may fulfill the first requirement, that is, stem removal.

There is also the possibility that this device may, when properly modified, serve to remove boll bases.

A crude working model of the stick removing accessory to the differentiator was constructed during October 1956. For want of a better name we refer to it as "The Magic Carpet.". This carpet is a single flat canvas conveyor belt with a sponge rubber surface cover made up from a number of 18"x30" household sponge rubber floor mats. What is ordinarily the floor contacting surface of these mats has demonstrated the bent stick-removing properties of any plastic material thus far tried.

Although operation of the device is apparently simple, many variables are present. A few of the more important include: Carpet surface texture; method of operation of carpet; height of feed discharge above carpet; rate and degree of opening of feed; angle of inclination of carpet; speed of carpet; etc.

Fourteen (14) exploratory tests were made in an effort to narrow down the range in a few of the more important variables in order to enable us to use one "setting" of the carpet conditions as a starting point. Then the suitability of the device with this setting, was investigated for each of the various fractions from the Differentiator floor pattern between 15 and 60 feet.

Maintaining one setting and method of operation, a series of nine (9) single-pass runs was completed. These runs were made using 9 fractions located between 15 and 60 feet in the floor pattern obtained from a single-pass projection of the differentiator of one lot of seed containing 4.59% foreign material.

Cleaning effected with the Differentiator alone and the extent of the improvement attained using the Magic Carpet is illustrated by the data presented.

Comparative results are shown on processing one lot of seed with and without the Magic Carpet. Starting with 2000 pounds of cottonseed having a foreign matter content of 4.59 percent and obtaining the usual 100 foot pattern by use of the Differentiator only we obtain three portions.

(a) The first 15 feet forward of the machine out of the original ton of seed fed to the machine, consists almost entirely of foreign matter to the extent of 41.2 pounds.

(b) The portion of the pattern from 15 to 60 feet contains a total of 1818 pounds of clean seed and 50.2 pounds of foreign matter.

(c) The final portion from 60 to 100 feet, the highest quality portion, had 90.3 pounds of clean seed and 0.292 pounds of associated foreign matter.

(d) That portion of the total pattern which has an average foreign matter content, arbitrarily selected, of 0.75 percent existed between the 41.8 foot and 100 foot points of the pattern.

Those portions of the seed pattern at the ends of the total pattern, namely, up to 15 feet and beyond 60 feet, were obviously satisfactory portions from a total reject standpoint and a satisfactory accept standpoint, respectively, and no further reprocessing consideration was given these portions. The intermediate length between 15 and 60 feet contained the bulk of the stems. It was this portion which was reprocessed in the "Magic Carpet." This feed to the "Magic Carpet" was separated into the two product quantities which we identify here as "rejects" and "accepts." The "rejects" were the fraction carried over the top of the carpet, and the "accepts" were collected as run-off at the bottom of the carpet.

The 1818 pounds of clean seed separated into 186.5 and 1631.5 pounds, respectively, of clean seed. The 50.2 pounds of foreign matter associated with the clean seed fed, separated into 34.5 pounds of foreign matter in the "rejects", and 15.7 pounds of foreign matter in the "accepts."

Note that the "reject" stream contained over twice the foreign matter discharged in the "accept" stream. Note also that the clean seed in the "rejects" amounted to only one-ninth of the clean seed recovered in the "accepts."

The difference in yields of low foreign matter content seed (0.75 percent) between differentiator operation only and differentiator plus "Magic Carpet" combined operation is significant. The yields increased from 51.8 percent by weight of original feed, to 84.8 percent when "Magic Carpet" operation supplemented the Differentiator operation.

An increase in yield of 0.5 percent F.M. seed is also effected from 13.5 percent to 18 percent. This difference, however, is not as significant as in the case of the 0.75 percent product.

The distribution of the various trash components in the feed and in the two discharge streams of the "Magic Carpet" was studied.

Weights of shale, wall, stems, and boll bases in the streams based on the original seed fed to the Differentiator were determined. Of particular interest are those components in the "Magic Carpet" feed that were most successfully separated by the Carpet. The "reject" stream carried off over two-thirds of the total trash. The boll bases or "knobs", which have weight and shape characteristics closest to that of the seed, are an unsolved problem.

As a matter of interest, the 15-60' fraction that was fed to the "Magic Carpet" contained an average foreign matter content of 2.69 percent.

In conclusion we wish to call your attention to the following:

(a) No recycling of material is represented in the data shown.

(b) The foreign matter content of the original feed to the Differentiator is considered high, 4.59%. This resulted in an average feed to the Carpet containing 2.69 percent foreign matter.

(c) The seed, so far, is being opened and fed by hand methods.

(d) The conditions of operation of the Carpet were selected from the results of ranges tried in (14) exploratory experiments and are not necessarily the optimum.

In order to have some data available for this meeting, only a limited study in the selection of approximate best settings could be made.

DISCUSSION

Woodruff: Of what does the cottonseed of the reject fraction consist?

Holzenthal: The reject cottonseed is cottonseed of slightly lower quality, and exploratory work has shown that the very fuzzy seed can be captured in that fraction. We plan to study what happens when the seed are repassed on the carpet. Indications are that with a repass, the cottonseed in this original reject fraction can be recovered much more thoroughly including the very fuzzy seed.

Allen Smith: If you have a ton of cottonseed which has a total foreign matter content of 4 percent, how much seed would be mixed up in the actual amount of sticks you could remove?

Holzenthal: That's the study that is coming up next. We know that as we process the fractions from 15 to 60 feet on the carpet, that they act a little differently from the 1st fraction to the 9th fraction. Just how we are going to group those to repass them on the carpet will be studied next. I can't tell you too much about that at the present time.

Bush: The fraction containing the fuzzy cottonseed probably contains a small amount of cotton also. What I have in mind is what is normally ginned in a grabbot gin.

Holzenthal: Yes, the fraction containing fuzzy cottonseed also contains cotton lint and extremely long first cut linters which can be recovered.

PANEL DISCUSSION ON LINTERS

By

E. A. Gastrock, Moderator, Head, Engineering and Development Section, SURDD
M. E. Whitten, Agricultural Marketing Service, Washington, D. C.
M. H. Fowler, The Buckeye Cellulose Corp., Cincinnati, Ohio
T. M. Gluyas, Mississippi Cottonseed Products Company, Jackson, Mississippi
L. L. Holzenthal, Southern Utilization Research and Development Division
Richard Hall, Agricultural Marketing Service, SURDD

Gastrock: You will recall that last year we had a very extensive discussion on linters, between producers, dealers, brokers, and users. I believe that as a result of that discussion we have probably brought these representatives of the various segments of the linters industry into somewhat closer contact, but there is still room for much closer cooperation within the industry.

Some reports on progress made during the year were given this morning by speakers of this panel. Mr. Holzenthal reported on research this Laboratory is doing to improve the cleaning of cottonseed and thereby improve the quality of linters. Another effort by the Laboratory has been to try to improve the utilization of linters in paper. We have engaged in close cooperation with some of the manufacturers of high grade papers, and have actually prepared chemically modified linters designed to give better beating strength characteristics for improving high grade paper. I understand that last year it was reported that roughly 1/3 of the rag content of so-called rag papers was derived from linters. Does anyone have any later information? Apparently not.

I feel sure that linters have held their own, and that we will continue to find means of promoting their utilization, and increase the quantity of linters it would be possible to use in high grade paper.

Fowler: Most of these talks so far concern the use of 1st cut linter standards. I would like to ask if anyone has sold any linters since the new standards came out on the basis of the new types?

McKnight: Yes, about 80% of our 1st cut linter sales were based on new type standards.

Gastrock: Does anyone else have any information to offer?

Hall: Not being as concerned with the technical aspect of linters as much as the economic, during the discussion of the standards I was really at a loss as to perhaps know the reason for the difference of opinion on the change of standards as it affects the industry. Apparently, Buckeye, with the larger number of mills, is concerned with producing a particular grade at a particular mill, and has a different problem than an individual mill operator. Apparently, Western Cotton Oil Co., claiming their linters are being sold by the new standards, finds that is their major problem, and that an individual firm having only one mill finds it easier to change their operations than does a larger organization.

Looking at the linters market this year and last year, I was attempting to find some explanation for the change in price this season which was much greater than would normally be expected. I find that the consumption dropped about 7 percent over the first five months as compared

with the record consumption of last year, but looking at the prices in the Weekly Cotton Linters Review I find prices about 70 percent above. I don't know if the standards have anything to do with it. I'd like to be corrected. I don't think they do, but from a market viewpoint if the customer can determine the quality of his product better, he is of course more apt to pay a premium price for it. Thank you, Mr. Gastrock, that's the only observation I can make at this time. Perhaps someone could straighten me out on it.

Fowler: I don't think that we'd better confuse the price of linters this year with the new standards. They have absolutely nothing to do with each other at this time.

Adams: I wouldn't say that changes in grade had anything to do with the decrease in usage of linters this year.

Woodruff: Is this new grading system so broad that we are going to be marketing cotton linters within a certain grade at various prices at the same time, and I mean quite a variation in prices at the same time? Do I make myself clear? For instance let's take #4 grade. Is that classification so broad that you're going to have quite a variation of price, as I got the implication here this morning, within that grade?

Fowler: Mr. Woodruff, according to the information in the weekly bulletins, the #4 grade, like most of the others depending on the staple, might range in price as much as a cent a pound. That was not part of my argument. My argument was that the #4 grade includes linters over such a broad range of the old grades that we were totally confused when we tried to price it with regard to whether the new #4 grade was a two middle linters or a 3 low linters. There's a world of difference.

Whitten: One thing attempted in the new standards is to differentiate between grade and staple. In talking to various end users of linters of the felting type we learned that certain of those people were interested in staple, others were interested in grade. In other words if the manufacturer made felt to sell to mattress makers he was more interested in getting a bright felt than he was in the length of the fiber that he used. He was willing to pay more for brighter linters than was another man who made his own mattresses and covered them. And in many instances there could be a difference in the price due to the demand from that particular manufacturer and that could, in some way, account for the price differential that might not be so readily seen otherwise. That was one of the reasons we found that the staple and grade should be separated, and in most instances it was requested that be done so that the supplier could get what he wanted. If he wanted color he paid the premium for it, if he wanted staple then he was willing to pay more for that, and in many instances they wanted both. During this past year we noticed that there was a brightness of lint in certain areas and a considerably shorter staple than there had been in previous years. Using the old system that would have been graded on an average of the two, and it depended on who graded the linters as to whether it would be graded a little up or a little down. You're bound to be biased one way or the other - that's just one of the fundamentals of the trade. I think some of our differences may be accounted for by demand in certain instances for color, and in other instances for staple, just according to what the end-user wants. Whether or not they are

available, influences whether the trade will be made, and we have found in many instances that some slight differential could be accounted for by the supplier's demand that it be one or the other.

Fowler: Mr. Whitten, I hope that you are not saying that the grade of linters is determined by the price that somebody is willing to pay. Actually, we had hoped that we would get a little bit away from that, and that a new type would be set up where a #4 staple was worth the same thing, provided all the other grading factors are equivalent. Actually, I don't think that this new grading system has quite accomplished that, nor does it boil down easily to a single number that can be used in grading. Also, it doesn't correlate at all well with the old practice with which most of us have become so familiar, therefore, there's a certain amount of difficulty to be overcome there just as with any other change. That might be overcome, I don't know.

McKnight: There are some things said that are a little bit conflicting. In the first place, in a sense the new grading system does not broaden the grade, but it narrows the grade. Previously we used a system where we had 1 high and 1 low and 1 middle and if we used a grade from 1 middle to 5 low, it covered 14 individual grades or sub-grades. This system that replaces it theoretically covers only 7 sub-grades or 7 grades but when you add the staple into it, it increases the description or narrows the grade probably where we have about 21 grades as opposed to 14, so we're really speaking in two different senses when we talk about a grade 4, unless you combine it with a grade 4 staple. It could be a grade 4, grade 3 staple or a grade 5 staple which in effect is three different grades of length as opposed to 1 when you're speaking of grade 4. This doesn't narrow it, it really broadens it, and broadens it more in line with the terms that are used by the trade.

Whitten: The department is well aware that we do not have a perfect system by any means and we would welcome suggestions and criticisms from any and all of you so that we might improve the standards. As I said before the standards are based on what we found that you wanted to the best of our ability. We know that there will be necessary changes in the future and we would be very happy if you would assist us in making the linter standards the best possible type standards to base trading on. Please bear in mind that these standards need further improvement, and we intend to improve them as you show us the improvements are needed.

Woodruff: Have you found that the new system of standards has fitted into the sales pattern in any one particular area in the United States?

Whitten: Since these standards have been used for such a short period of time our information on the extensive use of the standards is rather limited. We have not gone into the field and checked thoroughly. We know that some people have used the standards very well and we know that it doesn't suit others. We also realize that anything new is going to require considerable time to either be used extensively, or be rejected. At this time I feel that I cannot answer your question.

Quinn: Mr. Whitten, has there been any attempt to develop a rational basis for arriving at linters quality or grade? I'm thinking of selectivity for color, and staple lengths for the staple portion.

Whitten: We used the Nickerson-Hunter colorimeter in developing the present standards - the grading standards as they now exist. We have taken color measurements on all the samples that have been sent to the department for the last five years, and it was three years of statistical samples that we got from mills over the United States that we used in developing the present standards. We still use the colorimeter on every sample that is sent to Washington for grade; on the statistical samples that are used to estimate the grade of the linters as they are being produced, as well as the samples that are sent in for grading. We are having considerably more difficulty on staple length of linters because it is so difficult to determine. At this time we determine staple by means of a combination of two methods. In one we use the Suter-Webb Sorter which separates the linters into one-thirty-second inch components. The other method we use is what the linters graders call the drag strength method.

Quinn: I didn't realize that. Is that also true of the previous standards developed in 1925-26.

Whitten: It was all on sight and feel. Purely from the human element.

Quinn: Then this new system does have a rightful basis.

Whitten: Using our board and the best classifier we could obtain, we determined what we considered to be certain grades and certain staples. Taking those samples into our laboratory we tried to develop means whereby we could establish bench marks that would stand up scientifically, and based upon those scientific bench marks we intend to establish a new standards that they provide.

Quinn: In other words those primary standards, or bench-marks as you call them, should not be as likely to deviate as the previous standards.

Whitten: Yes, we feel that we have improved considerably in the last two or three years, but we know that we still have a long way to go because of the harshness entering into the special staples. In other words if your linters are extremely hard, one man may classify it different than a man who has been in an area where they have extremely soft linters. There are a lot of problems to be worked out but we are much closer than we were.

Hickey: Have you compared by measurement the performance of the ARS Differentiator with conventional type cleaners?

Gastrock: In order to make such a comparison, what we could do in getting samples of seed is to obtain relative information from the mill about the results they are getting on that particular lot. That may be more difficult than it sounds because we have no way of evaluating results at the mill the same way we evaluate here at the Laboratory. We very carefully weigh every fraction and then we calculate the results back to a ton of seed with no loss whatsoever. I don't think those results will always be available at the mill. We might do it on the basis of representative samples of cleaned and uncleaned seed and on examination of the trash which is thrown away, but there again we will have to have exact weights to correlate the two. I think that generally we could get some information but it wouldn't be as accurate as we'd like.

Holzenthal: You would also need a closed system.

Gastrock: I would like to ask Bentley Page this question. I believe in general the experience with cleaners is that approximately half of the total trash is removed in one pass. Then half of the remaining trash is subsequently removed in the first cut linters. Perhaps with that as a guide, an evaluation of the results of cleaning might be made.

Page: I believe we have removed up to 64 percent in the Bauer cleaner, however, I can't say what the percentage of trash was in the feed. I think you're approximately right on the percentage of trash removal on subsequently passing cottonseed through the first cut linters.

Holzenthal: In stating what a cleaner can do it becomes apparent that it is necessary to specify the initial foreign matter content and characteristics.

Gastrock: What Mr. Holzenthal just said explains why we have tried to characterize the trash into at least four different components, and by doing that we have been able to show our success with each one of the different components, so as to pinpoint the problem.

Woodyard: To what extent are the cottonseed cleaned prior to being fed to the Differentiator?

Holzenthal: The cottonseed are passed onto a perforated shaker to remove the rocks, extra-large trash, and some fine sand. The Differentiator does not handle large size rocks, pieces of steel, etc. The very fine sand is no problem; it comes out as soon as it enters the Differentiator.

INDUSTRY TRENDS AND RESEARCH NEEDS

THE IMPLICATIONS OF PRESENT TRENDS IN THE INDUSTRY ON PROCESSING METHODS AND QUALITY AND UTILIZATION OF THE PRODUCTS

By

E. A. Gastrock
Southern Utilization Research and Development Division

It seems proper for us engaged in cottonseed work to ask ourselves the following questions in analyzing the present and future status of the cottonseed industry, in determining what role we individually and collectively can perform in improving the situation. These questions are challenging ones worthy of our serious consideration.

1. WHAT ARE THE TRENDS AND CHANGES IN PROCESSING METHODS, AND QUALITY AND UTILIZATION OF PRODUCTS, AND WHY DO WE HAVE THESE TRENDS?

We have trends because of raw material dynamics, technological changes, rising costs and a desire or need to make product improvements.

Raw material dynamics.

Plant breeders, in their effort to improve the lint or seed may change the oil or protein content of cottonseed, hull thickness, linters content, gossypol content, etc. These changes may require revisions in processing methods.

Crop diseases and insects are requiring wider use of various chemical treatments in the field. Such treatment could affect the processing

characteristics of the seed, and in turn require processing modifications. In some areas heating of the seed upon receipt at the mills is used to combat the pink bollworm. Insect control may also restrict transportation of seed.

Cropping changes such as irrigation, mechanical harvesting, defoliation, etc., have influenced yields, cottonseed quality and composition, product quality, etc., and consequently influence processing techniques. Ginning practices such as cleaning, drying and heating also influence product quality and subsequent processing at the oil mills.

There is considerable competition for seed and the ability to buy cottonseed determines the length of operating season. The tendency toward fewer and larger mills, and longer operating seasons is continuing.

The spread between the cost of cottonseed plus manufacturing costs and the value of the products varies from season to season.

Availability, profitability and other aspects of processing of other oilseed crops (soybeans, peanuts, sesame, flaxseed, rice bran, castor) must be considered. Soybeans may be sold for export if it is less profitable to process them for oil and meal.

Technological changes.

Numerous technological changes are taking place. These include: the continuing trend away from hydraulic pressing; higher speeds, extended barrels, and higher temperatures in screw pressing; a greater proportionate share of oil extraction during the solvent phase of prepressing; and numerous variations in direct extraction, such as chemical degossypolizing, filtration-extraction, degumming, etc. In addition, changes in preparation include more cleaning with subsequent processing of purer meats; and cooking for lower refining loss, with importance given to water content. Generally, the trend has been to lower temperatures in processing, except as noted above for screw pressing. Improved instrumentation and control of seed house temperatures, use of more uniform solvents, and a better concept of process control are other technological changes of importance.

Costs.

An effort to curb rising costs is responsible for many of the trends. Labor costs have risen and may go even higher, while increased tonnage has tended to reduce unit costs. Technological improvements should reduce costs and improve products, and machine-power is continuing to replace manpower.

Product trends.

The trend to improve all products continues - oil, meal, linters, even hulls. Efforts are in the direction of producing cottonseed oils with a lower refining loss, better color and stability. Degumming is being tried. For cottonseed meals, the effort is toward a higher nutritive value and lower total and free gossypol content. The trend has been also to produce linters of cleaner and more uniform grades. Therefore, it becomes evident that the effort is not only on reduced costs or improved quality, but a combination of both-(costs x quality).

2. CAN WE INFLUENCE TRENDS? DO WE DRIFT OR DO WE STEER? DO WE RESENT CHANGE OR WELCOME IT? IS OR SHOULD ALL OUR EFFORT BE DEFENSIVE?

The present trends are largely defensive and will probably continue so for sometime. They result largely from circumstances and events foreign to the industry itself and not subject to its control. Examples are: the phenomenal growth of the soybean industry; availability of new processing equipment and methods; rising labor and other costs; changes in the domestic and world-wide fats and oils situation; increased consumer demand for meat products, and the rapid rise in poultry and egg production which have in turn greatly increased the requirements for oilseed meals; improved rural roads; and others. These circumstances have in various degrees influenced the trends toward the reduction of unit costs, elimination of smaller mills, improvement of oil yields, processing of more than one oilseed, and the meeting of competition of other products.

To be of greatest benefit to all concerned, future trends should be offensive rather than defensive. They ought to be influenced by thinking from within the industry rather than by outside influences, and should stem from a genuine desire to make the highest quality products and to fill the nutritive needs of men and animals. The need to make improvements must be met by the ability to make improvements with commensurate reward for such accomplishments.

3. COTTONSEED PROCESSORS HAVE A RESPONSIBILITY AND AN OBLIGATION.

Approximately 5 million tons of important food, feed, and industrial raw materials pass through your mills annually. I believe that your prime obligation is to conserve and maintain the inherent values in every ton of that raw material. Wherever possible, values should be added to the quality of the products. Yields and efficiencies must be maintained. Operating in this manner should yield the greatest profits.

Trends can be influenced by means of a concerted effort in accordance with a long range plan. Cottonseed products once dominated the vegetable oil and protein markets. If the latent qualities of cottonseed products are fully developed they might again assume a dominant role.

4. RESEARCH HAS MADE A CONTRIBUTION AND CAN BE EXPECTED TO MAKE MORE.

The current oilseed research program at the Southern Branch includes research (1) to determine important basic and fundamental information. (2) to develop new or improved processing methods, and (3) to develop new or improved products. Oilseed research should be continued by individual processors, by associations, universities, commercial laboratories, and the U. S. Department of Agriculture (ARS, AMS and others). Cooperative research should be encouraged and expanded. The climate appears to be right for expanding utilization research.

NEW CROPS AND CROP SHIFTS

By

T. H. Hopper
Southern Utilization Research and Development Division

A combination of factors has increased the interest in the search for new and replacement crops. These include surpluses of staple crop products, changes in dietary habits, increased production costs, and reduction in exports. In addition to the long-term efforts of plant scientists, an organized utilization research program has been initiated. This is justified on the fact that the products from new crops must have a market. The scope of this program is broad. It encompasses a search for plants having potentials for economically supplying such products as fibers for paper, gums, resins, medicinals, unusual oils, waxes, condiments, essential oils, high-protein forage materials, and fruits. It is probable that strong emphasis will be given to those plants producing industrial or non-food products, as for some time foods may be in surplus production.

Crops which have been under study for some time, including some commercial production in some instances, include sesame, sunflower, okra, kenaf, bamboo, ramie, guayule, safflower, and castor.

Of the three edible oil-producing crops, sesame appears to offer the best prospects. Progress has been made in developing non-shattering varieties. However, there is need of further research on cultural practices, and it must be recognized that sesame, sunflower, and okraseed oil would compete with cottonseed and soybean oils in food uses.

The fiber crops mentioned may not be considered replacements for crops now in surplus because of their climatic adaptation. Kenaf has possibilities as a crop for the production of a fiber similar to jute and useful for making sacks, carpet backing, and the like. It may be adaptable to the Rio Grande and the Gulf Coast areas. Methods of harvesting, decorticating, and degumming ramie have been developed to the stage that ramie culture may be attractive in Florida and some Gulf Coast areas. The market for ramie has not been fully developed. For some uses it would compete with cotton.

The increased cost of newsprint has increased interest in utilizing crops other than timber as sources of paper pulp. As a result of some long-term studies, the Agricultural Research Service has arranged for some semi-commercial plantings of timber bamboo near Clemson, South Carolina. There are a large number of timber bamboos which are adaptable to a wide area in the United States.

As a result of their rapid growth, it has been estimated that 6 times as much paper pulp may be obtained per acre annually as from southern pine. Cultural practices and possibly harvesting and processing methods need further study to determine the production and utilization of bamboo.

The Department has done extensive research on guayule as a source of natural rubber during World War II and subsequently. It is understood that a comprehensive program to improve the production potential of guayule through genetical and agronomic research has been initiated. This indicates that some feel that the crop is promising. Its culture may be limited to California and some other western states.

Safflower is now grown commercially in California and Nebraska. The oil is high in linoleic acid and commands a market for the production of protective coatings. No estimates may be made as to what may be the future demand for safflower oil.

Jojoba is being investigated extensively by the Agricultural Research Service as a source of a liquid wax, which through chemical modification may serve as a replacement for imported waxes. Its future as a crop will depend on the plant scientists to improve it genetically and to develope the essential information as to where and how it may be cultivated. It appears that there would be a ready market for any reasonable production of jojoba oil.

Of the crops mentioned earlier, castor offers the best prospect as a replacement crop across the southern half of the Nation. The oil has a large number of industrial uses which may be increased through utilization research, including plastics, plasticizers, lubricants, protective coatings, films, and industrial chemicals. Through the development of harvesters by use of which practically all of the beans may be collected and the success of the geneticists in developing new and hybrid varieties, the economics of production looks encouraging. These accomplishments are the result of 15 years' research effort. Yields of castor beans vary considerably -- 800 lbs. per acre in Oklahoma to 3,000 lbs. per acre in California. It has been estimated that 200,000 acres of castor beans may be grown annually within 3 or 4 years, and that within 15 years the demand may be for the production of 1,000,000 acres.

Because of the presence of toxic and allergenic principles in castor beans, it is obvious that they should not be processed in oil mills processing edible oil-bearing seeds.

The full value of the castor crop cannot be realized until higher-value uses are developed for the pomace. At present it is used almost exclusively as a fertilizer. Methods must be developed to alter or inactivate the toxic and allergenic substances, not only for health reasons in processing plants but also in developing industrial and feed uses. It is reasonable that castor pomace may have industrial uses similar to other protein meals in the manufacture of sizes and adhesives.

The value of a new crop can only be realized when its production is well established and the needs of phases of production, marketing, processing, and utilization have been reasonably well investigated. We have seen the introduction of soybeans as a major crop. It must be recognized that many years of effort were expended which made it possible. It may be some time before any of the crops now under study may be equally well established. Castor is nominated as the most promising candidate. It satisfies the current desire for use of land for the production of industrial rather than cereal crops and cotton.

American agriculture is characterized as dynamic and readily willing to diversify and shift production when shown that there is an economic advantage. The long-term shifts are well known. Scientific and technological developments constitute a force now at work which makes every prediction based on trends of the past purely provisional. The demand for raw materials that supply manufactured products for consumption are limited only by the ingenuity and diligence of the people who set out to meet or anticipate these needs and wants. The future should see greater industrial

use of agricultural products, leading to a better balance between production and consumption, even before the population has increased to the point at which there may be a demand for food and fiber beyond our production capacity. In view of the increasing efficiency of American agriculture this situation is not in the foreseeable future.

RESEARCH NEEDS

PART A

By

H. L. E. Vix
Southern Utilization Research and Development Division

During the period 1870-1942, there was very little change in the method of processing of cottonseed. During the war, between the years 1942 and 1945, we saw a gradual introduction of mechanical processing means such as screw pressing. From 1945 to the present date we have seen the rapid change in the method of processing of cottonseed. These processing conditions have been brought about by several changes in cottonseed growing. One, is that the growing of cottonseed is moving westward. States like California, Texas, and Arizona are increasing their production of cotton. Within a few years new processes began to gradually reduce the amount processed by hydraulic pressing and today processing of cottonseed is about equally divided among hydraulic pressing, screw pressing and solvent extraction methods. Many of you here this afternoon participated in that industrial revolution of the cottonseed processing industry and played an important part in bringing it to its present status. This laboratory, during the past 10 years, has done much to contribute information on research in many of the areas pertaining to the cottonseed processing industry. New analytical tools have been developed with which we can measure the chemical properties of our seed, our oils and our meals, such as measurements of gossypol, both free and total, present in the meal, and gossypol-like pigments present in the oil. We have developed information on the effect of variety and environment on the composition of the cottonseed, with respect to oil content, phosphorus content, protein, gossypol, and other constituents. We have performed research on storage of cottonseed, and have worked very closely with groups like yourselves and others on the effects of processing conditions such as moisture, temperature, and time used for the various operations. By such means information on hydraulic pressing, screw pressing, pre-press solvent extraction and the direct solvent extraction methods have been obtained. Now the effect that conditions of processing have upon extraction efficiency, quality of meal, and the quality of oil are better understood. I suppose you have wondered why we spent so much time on the pigment glands of cottonseed, but in so doing we have found much information that bears a direct relationship to the quality of the oil and the quality of the meal. In our studies we've pointed out that the pigment glands constitute just a small part of the cottonseed itself, approximately 2 or 3%. These pigment glands are of a

size that fall between the opening of your rolls of say from two to ten thousandths of an inch. During rolling many of the pigment glands are fractured or ruptured, but not enough to cause complete removal of the gossypol during processing. We've learned much about the composition of pigment glands and have worked on many ideas at this laboratory such as the fractionation process by which we separated cottonseed into pigment glands, essentially gland-free meal, and oil. From this work, it was learned that it was very difficult to prevent rupture of some of the pigment glands thereby causing part of the pigmentation to be spread on the meal and also in the oil products.

The Laboratory has been asked again to investigate, with industry, the method of processing, such as screw pressing and hydraulic pressing, and the effect that modification of these processes have upon the chemical properties of the oil and the meal. The effect of low temperature screw pressing, mild rolling, and mild cooking might be cited as examples of such modifications. The process changes resulted in the production of a meal that seemed to have better nutritive value but an oil in which there was complete pigmentation. The oil upon standing would revert easily and would not refine and bleach to a very light color. Methods of rolling and cooking as a means to improve and lower the gossypol content both in the meal and the oil were then referred to. It was found that by improving the rolling conditions and also giving more attention to the conditions during cooking, such as time, temperature and moisture, all the gossypol could be effectively bound into the meal; and a meal could be produced with low-free gossypol content, and an oil extremely low in gossypol-like pigments.

The effect of pH upon the chemical properties of the oil and the meal was studied during cooking of the cottonseed. We worked on the effect of moisture during the preparation operations, and also developed ideas to prevent fixation of color in cottonseed oil, during solvent extraction and solvent recovery operations. Work was done on the preparation of proteins from cottonseed for fiber and glues. From research for better refining and bleaching methods, much information was obtained on the chemistry and composition and modification of cottonseed oil. The filtration extraction process was developed at the Southern Laboratory and has been used industrially for the processing of both cottonseed and soybeans. In our Laboratory work it was demonstrated that this process can be used for the direct extraction of other oil bearing materials such as flaxseed, castor, sesame, peanuts and rice bran.

During the course of ten years we have correlated many of the chemical properties of the oil and meal with respect to quality and have found a direct relationship although the results of our studies on quality were not conclusive, we know that the processing conditions used by some have an effect upon most of the qualities of the products and the extraction efficiency. Much is known about the nutritional value of the cottonseed meal today. More about that will be discussed in detail tomorrow. Controlled conditions during processing can result in the production of a meal that has improved value with respect to chemical properties, as borne out by certain nutritional tests; and in oil that has better keeping qualities. We have processes by which we can produce meal and oil with acceptable qualities and in which improvements can be made, particularly

improvements of conditions used during preparation, extraction and oil recovery operations. We'd like to say that we can take today's processes and make the best meal and the best oil possible. Probably we can, but more research is needed. There are certain areas where extraction has to be improved upon, since there are hidden oil losses.

We need a process by which we can rupture the pigment glands very easily and cause the pigmentation to be dispersed into a liquid medium so that it is not absorbed quickly upon the meal. The meal acts like an absorbent very similar to a bleaching material used in the bleaching of vegetable oils. We need to remove that pigmentation from the meal phase as quickly as possible, probably in an oil miscella phase, so that we can produce a meal with a low free and total gossypol content. The meal must not be subjected to a high temperature during processing at a high moisture content if the protein is not to be adversely affected, or if the essential dietary constituents are not to be altered. Such a process can be obtained only through research. And while we are on the subject of process, we need to work on the current one to find new ideas to improve some of the conditions and upgrade the products as time goes on, to meet the competition of other oilseeds.

There is a need for a process by which we can very easily remove the linters from cottonseed. In our research, we are improving the quality of the linters from the standpoint of cleanliness. However, our present method of delintering as we all know it, is one that calls for a capital investment representing a large percentage of the entire cost of the process. Such a process can be obtained only through research. More information is needed on the processing of other oilseeds in relation to cottonseed, because as time goes on the cottonseed oil mills will be confronted with the problem of processing not only soybeans but probably sesame and other oil bearing materials. More information is needed on the fundamental properties of gossypol and gossypol-like pigments, and on the chemistry of cottonseed oil and its fractions. It might be found that it is desirable to combine fractions of cottonseed oil with fractions of other oils to yield a product of higher dietary value.

RESEARCH NEEDS -- OIL

PART B

By

Frank G. Dollear
Southern Utilization Research and Development Division

As an approach to this subject I will tell you briefly some of the things we are working on now in the Laboratory and discuss what needs to be expanded of our present work and new fields that should be investigated. Progress is being made on determining the mechanism of color fixation in crude cottonseed oils and on the removal of gossypol, the precursor of dark colors, by addition of chemicals to form polymeric products. More research is needed to develop practical methods of producing lighter colored cottonseed oils. The ultimate objective should be processing for production of three materials - meal free from gossypol, oil free from gossypol, and gossypol or some derivative as a raw material for chemical or biological utilization.

We are carrying out research to find new uses for cottonseed oil as an industrial material, and as a food or coating for food products. We are studying hydrogenation and the shifting of double bonds taking place under different conditions of hydrogenation to determine whether there is a possibility of

using cottonseed oil, or its principal component linoleic acid to produce long chain dibasic acids which might be used as lubricants and plasticizers. The information obtained from this investigation will also contribute to our knowledge of hydrogenation, and may be useful in the food field as well where cottonseed oil is hydrogenated to produce margarine and shortenings.

Coatings for food products are being investigated from a standpoint of confectioners coatings for military use where they need a coating which will not melt at 100°F. but melts or appears to melt in the mouth when it is eaten, and from the standpoint of physical properties and behavior of confectioners coatings. This work is supported in part by the Quartermaster Food and Container Institute and the National Confectioners' Association. Acetoglycerides and polymeric fats have been under investigation and have possibilities of use as coatings and lubricants for use with foods or with food machinery. Research is being carried out to determine the effect of enzymes or microorganisms in the digestion of these new chemically modified fats, and under contract with the University of Southern California research is being carried out to establish their edibility.

The importance of nutritional quality and health aspects of diet with regard to fats has received a great deal of publicity. Much of the work thus far has been carried out on samples of poorly defined character. While we are not now engaged in research of this type we feel that a great deal of research is needed on well characterized fats where the type of fatty acids and the position and configuration of the double bonds of the unsaturated fatty acids are well established. Ultimately, if we know what is best from the nutritional and health standpoint, we can learn how to process fats to provide the most desirable properties.

We are investigating castor beans as a replacement crop for cotton. One way to overcome surpluses is to grow something else which is not competing for markets with other surplus crops. Castor is a crop which produces a non-edible oil. New uses need to be developed for the oil so that a domestic crop can be established. Present approaches include chemical modification to produce plasticizers and chemical modification to produce urethane foamed plastics. Research in this field could be expanded and offers great opportunity. To summarize - research needs include: (1) Improvement of quality to retain present markets or to enter new markets. (2) Research to develop new uses in industrial and edible or food fields. (3) Research to provide a better understanding of the relation of nutrition and health to the characteristics of fats in the diet. (4) Research to expand markets for products from industrial oil crops which might be grown in cotton producing areas.

HIGH PROTEIN MEAL

PART A

THE EFFECT OF HIGH PROTEIN MEATS ON PRESS ROOM OPERATIONS

By

L. C. Roots
Anderson, Clayton and Company of Mexico

In the area in which we operate there is no general appreciation of either the quantity or quality of protein. At the present time we have

many consumers, particularly dairymen, who will pay a higher price for 24-28% protein whole pressed cake than they will pay for 38-40% protein cottonseed meal or pellets. A common method of testing meal for quality is to throw a handful against a smooth wall; if the meal sticks to the wall, it is considered satisfactory. Recently, however, some of the more aggressive mixed feed manufacturers have been analyzing their purchases and we believe that the next few years will see a great change in our marketing practices.

Over a period of years 38-40% protein has become accepted as the standard for cottonseed meal, probably due to the fact that the major cotton producing area of Mexico was for many years in the Laguna region of the states of Coahuila and Durango. The seed from this area are low in NH_3 and extremely dry, so that the production of a protein above 40% caused considerable trouble in the separating room.

My first experience with high protein operation was in 1936 before I was employed by Anderson, Clayton & Company. My employer was very interested in producing a high protein cottonseed meal for human consumption; and to make a product of acceptable appearance, it was necessary to produce a cake of the highest possible protein.

As this mill was equipped with two virtually identical press rooms, it was simple enough to separate pure whole meats for pressing in one press room while the residue was pressed in the other. This method of milling was continued for several years with approximately the following results:

	#1 press room	#2 press room	Average
	Cake		
Moisture	7.5	8.9	8.2
Oil	5.70	5.65	5.68
Protein	54.70	42.67	48.68
Standard	.54	.68	.61
	Oil		
FFA	1.4	1.8	1.6
RL	7.1	9.1	8.1

The high protein cake had a very pleasing light yellow color and, although we operated with approximately 12% difference in protein, the oil in cake was virtually the same in both press rooms. At the time we were doing this work, we felt that there were too many other variables to reach any definite conclusions concerning the advantages of high protein in hydraulic press room operations. Among other things, we were milling all of the immature and damaged seed in the low protein press room, and we were obviously obtaining much better rolling of the high protein meats. Until the time I left this company, no method of actually evaluating the effect of the high protein had been devised. I have mentioned this experience only because the results are interesting in that they are in conformance with more recent developments. These results might have been significant if we could have properly evaluated and applied what we were doing.

Historically, we have exported the bulk of our cake from Mexico as slab or flakes, so that the mill run protein has been controlled by our sales contracts. Now, several of our mills are selling all of their production domestically as meal. We have recently converted two of these plants to high protein operation, and have plans to convert three more.

Of the two plants converted, one is equipped with screw presses with cage extensions, and the other with standard Super Duo Expellers. In both cases the results were even better than our expectations; however, our discussion here will be confined to the plant equipped with Super Duos. Relatively uniform quality of the seed in the area where this mill is located makes us feel that the results before and after changing to higher protein may be assumed to be significant.

Based on our limited experience, we have noted the following results with high protein press room operation:

(1) Improved tonnage.

The production of cake per expeller remained approximately constant as the protein content changed. For an increase in protein from 38% to 45% we had a corresponding increase in tonnage from 100 to 118 metric tons per day.

(2) Improved cake color.

Probably, this factor is of no importance in the U. S., but our market connects a light color with high quality and we have found the finished meal to be much lighter in color when the hulls are removed during the pressing operation.

(3) Reduced maintenance cost.

It would be natural to expect a reduction in maintenance equal to the reduction in quantity of cake put through the expellers; however, our observations to date indicate that this saving will greatly exceed the actual percentage reduction in cake weight. Naturally, it will take some time to accumulate accurate data on this subject, but it appears that the maintenance cost will be reduced at least 50% and possibly more.

(4) Improved yield of oil.

All of our results to date indicate that there is no correlation between protein in cake and oil content. I fully realize that there are always enough uncontrollable variables in oil mill operation to make positive statements hazardous; however, we are safe in saying that we experienced no significant change in oil content with a variation of 10% protein in cake.

At our Delicias mill, we calculate a reduction in the amount of cake passing through the press room of 148 lbs. per ton of seed, resulting in an additional oil yield of 5.2 lbs.

(5) Reduced power consumption in press room.

We were unable to detect any increase in expeller motor loads, so we have assumed a saving of approximately 18% in press room power consumption. As there is no market for high protein material, this is partially offset by the power necessary to produce hull bran required for reduction of the protein to 38-40% as accepted by the Market. With present lint prices, however, the fiber plant is independently profitable, permitting the press room power saving to be a real gain in revenue.

In closing, I would like to repeat that our experience with high protein operation has been highly satisfactory, and as fast as marketing conditions permit, we are going to recommend that all of our plants be equipped to operate with the highest possible protein through our press rooms.

HIGH PROTEIN MEAL

PART B

MARKETS FOR HIGH PROTEIN MEAL

By

H. L. Wilcke
Ralston Purina Company, St. Louis, Missouri
(Presented by J. L. Milligan, Ralston Purina Co., St. Louis, Missouri)

The feed manufacturing industry needs high quality - high protein concentrates for use in those rations where relatively high protein - high energy and low fiber are essential. This means that rations for chickens, turkeys, and swine would be the most important. Cottonseed meal has been finding its place in rations for broilers, replacement chicks, growing pullets and growing turkeys, and, to some extent, for swine. Processing is extremely important in determining the place that cottonseed meal can assume in these types of rations because the gossypol content must be low and the protein must be readily available and as nutritionally adequate as possible. Fiber is not utilized to any great extent by poultry and swine and therefore the hull should be eliminated as completely as possible if we are to get maximum usage in highly efficient rations. The use of a higher protein soybean oil meal has increased tremendously in manufactured feeds during the past year. This demonstrates the need for higher protein concentrates and presumably there should be no reason why the cottonseed meal that is used in highly efficient rations should not follow the same path. The availability of certain of the amino acids, particularly lysine and methionine, at prices which permit economical usage will increase the potential of low gossypol - highly available protein cottonseed meal for use in manufactured feeds. The ruminant utilizes fiber efficiently and economically so at the moment we can see no place for low fiber - high protein cottonseed meal in the ration for ruminants. The present type cottonseed meals should be satisfactory.

INDUSTRY TRENDS AND RESEARCH NEEDS

Panel Discussion By:

G. E. Goheen, Moderator, Assistant Director, SURDD
E. A. Gastrock, Head, Engineering and Development Section, SURDD
T. H. Hopper, Head, Analytical, Physical and Physical Chemical Section, SURDD
H. L. E. Vix, Southern Utilization Research and Development Division
F. G. Dollear, Southern Utilization Research and Development Division
L. C. Roots, Anderson, Clayton and Company of Mexico, Mexico D. F.
J. L. Milligan, Ralston Purina Company, St. Louis, Missouri

Goheen: Many thousands of new manufacturing plants, revolutionary by all world standards, have been built and many others have been expanded and streamlined for the manufacture of new products, and for increase in the efficiency of operation. An analysis of this industrial revolution indicates that research is a major contributing factor. During the last 20 years, research expenditures in the United States have jumped from a few million dollars per year to a current rate of over five billion dollars per year. Furthermore, there's every indication that this rate is not at the top. In fact, sound predictions are that this will increase to about 20 billion dollars by 1975. This is big business, and this investment will be made by hard headed business men who are convinced that an adequate return will be realized on their money. Thus, since research promotes change and progress, it will be necessary for leaders in various industrial fields to continually take stock of the trends and their effect on their own operations.

While we are today discussing industry trends and research needs we could well consider the subject as industry needs and research trends. Research provides new products of better quality to meet the desires of the consumers. These desires are based on basic human needs which may be classified as food, including feed and medicine, clothing, shelter, transportation, communication and recreation. From the standpoint of utilization of farm commodities these needs may be grouped according to food markets, feed markets and industrial markets. The cotton plant has a very prominent position in these three markets. However, expanded research on the part of many competitive interests has and is now strongly challenging this position. This is true for cotton lint and for cottonseed products. This competition can be met by adequate research and the application by industry of the accomplishment of this research. Today we have carefully analyzed our situation in order to concentrate our efforts on the most profitable objective and to fully coordinate these efforts for the greatest efficiency of operation. How can we maintain an increasing consumption of cotton lint, cottonseed oil, meal, linters and hulls, not only in these outlets but also in many rapidly expanding industrial outlets such as plastics, detergents, paint, and lubricants, insecticides and other products.

During the 1955-56 season when the entire cotton crop was valued at 2.65 billion dollars, cottonseed brought 269 million dollars to the farmer, or 10% of the value of the cotton crop. Of the over 6 million tons of

cottonseed produced, 93% was crushed. The total value of cottonseed products per ton of cottonseed crushed was $75.77 the lowest figure during the past 8 years. Although the oil obtained from cottonseed makes up less than 20% of the weight of the seed, its value is almost 60% of the total product value. Cottonseed oil is used primarily in edible products with small amounts going into inedible products. In 1955 almost half of the toal consumption was winterized for use in salad oils, cooking oils, salad dressings, mayonnaise and related products, compared with 37% in the previous year. Shortening accounted for 29% of the cottonseed oil used in 1955 - a decline of 36% in 1954 and only slightly below the average of the three years prior to 1954. Vegetable oil consumption in rubber, cosmetics, putty, and other inedible products during 1955 amounted to 450 million pounds, an increase of 37% over 1954. Although cottonseed oil in these uses normally accounts for a minor part of the total vegetable oils consumed, 1955 consumption was more than 2-1/2 times larger than 1954 consumption.

Cake or meal, the second most valuable product obtained from cottonseed, makes up about 45% of the weight of seed and about 30% of the value of products. Since cottonseed meal is a high protein feed, it is used principally in livestock feeding-primarily for cattle and sheep. About 1.6 million tons of cottonseed cake or meal were used in feed during 1955-56. This includes an estimated 200,000 tons of degossypolized cottonseed meal used in poultry rations. For upland cotton, linters usually make up around 10 to 12% of the weight of cottonseed as it comes from the gin but may range from around 7 to 15%. During the years beginning August, 1953 to 1955, linters comprised about 9% of the value of cottonseed products. Cotton linters probably have a wider variety of end-use markets than any other cottonseed product. Approximately 1.8 million bales were consumed in the U. S. during the 1955-56 season. Hulls are the least valuable cottonseed product. They account for around 20 to 30% of the original weight of the seed but less than 3% of the total value of products. Demand for hulls, like that for cottonseed cake or meal, follows the seasonal production pattern, since hulls are used primarily for livestock feeding.

At this conference we are giving full consideration to the market requirements as a reflection of the consumer needs. Evidence is being presented that cottonseed oils, meals, and linters of higher quality or having special properties are needed, and that progress is being made in research and in processing to provide these products. New outlets in industrial markets as well as they are in the feed markets are within reach. Nevertheless a broad view must be retained. Which will occur first - this expansion of new uses and new products from the cotton plant, or the replacement of surplus cotton production with new crops capable of providing higher quality products for the consumer at a lower price? The rapid growth of soybean consumption is a reality. Will castor or jojoba or sesame also make inroads or even replace the cotton plant? Castor can provide even today a good fiber and good lubricant, it may soon be used as a satisfactory feed. Future research will have to provide the answers to many of these questions. Events may move rapidly, and the operator ready to shift his process rapidly to take advantage of these developments will be the one to profit.

Fowler: Dr. Milligan, I wonder if you would care to hazard a guess as to what proportion of cottonseed meal production could be utilized as a high protein meal.

Milligan: We do not have enough cottonseed meal to replace all of the soybean meal. The extent to which we can use cottonseed meal is limited somewhat by its amino acid content, as far as lysine goes particularly. Until that is solved, I judge that we could replace somewhere between 1/4 and 1/2 of the soybean meal in any of the rations for swine and for poultry. The percentage will vary with the type of livestock.

Easley: Dr. Milligan, you have been talking in terms of 50% cottonseed meal. Must the protein content necessarily be that high, or would 47% serve the purpose? I'm concerned about manufacturing problems and conditions.

Milligan: Actually, the nearer we could get to 50%, the better, because basically, we're facing competition with 50% soybean meal, and formula space requires the use of as highly concentrated a source of protein as possible. If we drop down below the protein content of soybean meal we have automatically created a handicap for cottonseed meal. Growth is important, but also, and perhaps more important than is frequently realized, is the question of feed conversion. For example, if you just improve the final weight of a bird by one tenth of a pound and compare it to an improvement of merely one tenth of a pound less feed per pound of meat produced, you've made a much greater contribution toward lowering the cost of production by the improvement in feed conversion than by the improvement in growth; and fundamentally, the higher the concentration of protein that's in a feed stuff as long as you are buying that product primarily for protein, the better, from the standpoint of formula weight, efficiency and often profitability.

Easley: We can make 50% protein meal if the protein in the seed runs around 4%. If it is lower, then we have trouble mechanically.

Woodruff: Are we correct in assuming that the 50% protein meal that you speak of is a degossypolized cottonseed meal?

Milligan: That would be a fair assumption. The gossypol content and associated factors that produce the egg problem are the limiting factors which eliminate cottonseed meal at the present time from about 20% of its potential market, at one stroke.

Woodruff: It would have to be a 50% protein degossypolized cottonseed meal.

Milligan: That essentially is the direction which we believe it should move in.

Quinn: Dr. Milligan, what are you thinking of when you say degossypolized meal? Of what range are you speaking?

Milligan: That's a pretty fair question and it would have to depend upon the animal I suppose as to the importance of it. For laying birds, I would say 100% completely degossypolized. For swine, turkeys, and chickens not laying eggs, I think that for the present about .04% would be about the maximum we'd like to see. I think that here is an opportunity if we accept it. If the cottonseed processors establish a high protein cottonseed meal, it should be essentially free of gossypol in order to solve some of the storage and handling problems for feed manufacturers.

Smith: Mr. Roots, in relation to operating high protein press rooms, do you cook the high protein meal by using less heat in cooking?

Roots: I have to answer that positively. We haven't approached it from that viewpoint but we have noticed that you can produce a residual cake with a high moisture content with a higher protein which I believe means that possibly we're using a little bit lower temperature in cooking but we don't have any positive data on that.

Patterson: Dr. Milligan, what would be your position on shipping expeller cake having 45 or 50% protein, in bulk?

Milligan: I don't know.

Quinn: Now that we know that certain proteins, certain meals should have greater solubility than others, has there been any attempt or any thought of specifying a given solubility of proteins?

Milligan: There certainly has been some thought given to it. It has not been put through as you know and the reasons are that there are some contradictions as to what would be the best standards of that type, and the fact that long established trade practices would be upset. We don't know exactly how to set up precise specifications for quality on the protein standards. We know, in general that an overheated meal for example, will not produce good results and you can measure the loss in returns for the ultimate user very easily. Standards that will give the proper amount of protein and set it so precisely that it will eliminate all of the poor quality meals, and will not discriminate against some other ones that are also of good quality, are very difficult to establish at this time.

Pryor: Mr. Roots, do you know whether or not there's any difference in unaccountable oil loss whether you operate on high protein or low protein?

Roots: I honestly don't have any answer to it.

INTRODUCTORY STATEMENT

By

Allen Smith
Program Chairman, V.O.P.A.
Perkins Oil Company
Memphis, Tennessee

One more year of oil milling is history. Today we start our sixth consecutive year of discussions on how to better process cottonseed.

The five previous meetings have been interesting and informative. They have been profitable or else the attendance would be on the decline rather than growing each year.

Much planning and work on the part of the sponsors have gone into each program. Many people from different organizations and allied fields have given of their time and talents, also have paid their own expenses to and from here.

This year our object, as before, is to discuss problems pertaining to the cottonseed oil milling industry. Our theme: "A Changing Industry and Its Problems." The program as usual will last for two days and is divided into, as you will note, three parts:-

Progress Reports on Utilization of Linters.
Industry Trends and Research Needs.
Processing and Product Quality.

At the conclusion of each part there will be a panel discussion. The speakers from each part will please act as panelist. There will be an hour for discussion, more time may be taken if needed. In this time for discussion the whole group is privileged and expected to ask questions directed to different ones on the panel or to others from the floor. Your ideas and interest may be more appreciated than you think - Speak up.

It would be almost impossible to thank each of you who have and will make this clinic pay dividends. However, I should like to mention only two names. The Program Chairman is particularly indebted to Mr. E. A. Gastrock for his correspondence with and securing many of the speakers. Mr. C. E. Garner, as you all know has always done more than his share of the work. In fact, he is to this clinic what our first President was to our youhg country. Again, thanks to you all.

We would like to start our final section of our clinic, "Processing and Product Quality." Mr. P. H. Eaves, Engineering and Development Section, SURDD will please speak first and announce his topic - Mr. Eaves.

PROCESSING AND PRODUCT QUALITY

CAN NEUTRAL OIL YIELDS BE USED AS A BASIS FOR EVALUATING OIL MILL OPERATIONS?

By

P. H. Eaves
Southern Utilization Research and Development Division

At the last meeting of the V.O.P.A. at this Laboratory a very interesting panel discussion on the subject of oil losses took place. It appeared from the discussion that there was some diversity of opinion on the subject, a number of operators stating that they had no particular oil loss problems, while others reported substantial discrepancies between anticipated oil yields and those realized.

As all of you know, and as was brought out in the course of the panel discussion last year, the composition of the lipides material determined in a given lot of cottonseed as "oil" (or total oil) by analysis differs in composition from the crude oil produced from the same lot of seed. The differences in composition arise, not so much from differences in the nature of the materials making up the mixture which we call crude oil, but from variations in the amounts of the constituents of the oil. Generally speaking, an average crude cottonseed oil of prime quality consists of a mixture made up of from 93% to 97% neutral oil and 7% to 3% of impurities. These impurities consist for the most part of free fatty acids, phospholipides, the material determined as oxidized fatty acids, gossypol, and unsaponifiable matter.

I may be in error in thinking so, but I am inclined to believe that some of the oil balance problems may be the result of failure on the part of operators to give proper weight to differences in total oil yields which may be attributable to this cause. Actually, it appears that the oil mill superintendent is placed in the difficult position of attempting to balance a material of one composition in his input stream with a material of a different composition in his output stream. This situation is still further complicated by the fact that the composition of a crude oil produced from a given lot of seed may vary from day to day, or even from hour to hour, as a result of relatively small variations in processing conditions.

It occurred to us that some of the oil balance troubles might be cleared up by making a balance between input and output neutral oil. In this way it would be possible to know if the oil losses were real or only apparent, i.e., if all of the neutral oil in the input stream could be accounted for in the output stream (crude and cake), then there were no actual or real losses of oil even though the amount of crude recovered was less than anticipated.

We did some work on this problem on a laboratory scale which you may find interesting. In this study we worked with the meats only, since we were concerned solely with the effect of the processing conditions on the yields of crude and neutral oil. Four lots of meats were used and portions of each lot were processed for oil. One portion of meats was simply flaked and extracted with hexane "as is" to provide, as the material extracted from raw meats by hexane is, a control virtually the same as that found by analysis. A second portion was tempered, flaked and extracted, and a third portion was cooked and extracted. Extreme care was used throughout the work in an attempt to obtain an exact quantitative balance between the input raw meats and the output meal and oil.

Averages of the results of four runs, each of which was with meats from a different lot of seed, were used in preparing material balances. We did not attain 100% recovery of the input meats despite the use of extreme care, however, the results are within the range of experimental error. Actually, the greatest discrepancy occurred with the tempering process, and I am reasonably sure that this discrepancy was caused by the loss of moisture from the sample weighed out for the moisture analysis.

Average analyses of the crude oils produced from the raw, the tempered, and the cooked meats are shown. The "oil" extracted from the raw "as is" flakes corresponds closely in composition to the oil extracted from the same flakes by conventional analytical methods. The relatively low neutral oil content of this crude, and the relatively high content of the components making up the impurities were observed. For the crude from the tempered meats we found that the neutral oil content was 0.6% greater and the impurities lower, but that the relative proportions of impurities were different. The neutral oil content of the crude from the cooked meats was almost 3% higher than for the crude from the raw meats, while the percentages of other components were much lower.

The yields of crude and neutral oil from the differently prepared meats differed with the method used in preparing the meats for extraction. The yields of neutral oil were virtually unaffected by the method of preparation. It appears then, that both tempering and cooking preparations result in a "loss" of crude oil (that resulting from cooking being quite sizeable) but that there was actually no loss of the valuable neutral oil.

In making our calculations to a ton of seed basis, a yield of 1030 pounds of meats per ton of seed was assumed. The meal was split into two components, oil free solids and residual oil, and the crude oil into neutral oil and impurities. Also, for purposes of the calculation, the amount of residual oil remaining in the meal was added to the amount of crude actually recovered.

The data show that in processing by the solvent extraction method when meats are prepared for extraction by tempering, the processor is going to come out with about 1 to 2 pounds less total oil per ton of seed processed than he expected, but that he will actually not have lost any neutral oil. The processor extracting cooked meats would have a similar apparent loss of almost 10 pounds of oil per ton of seed processed, but here again there would be no real loss of any valuable or usable neutral oil.

In closing I would like to remind you of a remark Mr. Allen Smith made in concluding his remarks at the panel discussion of the last meeting. Mr. Smith said, and I quote from memory, "It almost seems that the less oil you make the more money you make!" In view of the foregoing data it appears very likely that Mr. Smith was correct, especially when we remember that a crude which is low in neutral oil and high in impurities has a disproportionately high refining loss and is discounted accordingly, whereas a crude high in neutral oil and low in impurities has a correspondingly low refining loss and would command a premium under the trading rules.

HIDDEN OIL LOSSES

Panel Discussion By:

W. G. Quinn, Moderator, Buckeye Cellulose Corp., Memphis, Tennessee
Allen Smith, Perkins Oil Company, Memphis, Tennessee
J. R. Mays, Jr., Barrow-Agee Laboratories, Memphis, Tennessee
F. A. Norris, Swift and Company, Chicago, Illinois
J. H. Brawner, Southern Cotton Oil Company, New Orleans, Louisiana
P. H. Eaves, SURDD, New Orleans, Louisiana
Walton Smith, Southern Cotton Oil Company, New Orleans, Louisiana

Smith: Last year this phase of our discussion was under the heading of "Unexplained Oil Losses in Processing Cottonseed." Today, a further study or progress report will be given by a Panel on "Discussion on Hidden Oil Losses."

This particular part has to do with the securing of information from different oil mills and laboratories, and arranging the data as you have on the separate sheet of paper being given you.

There is nothing in this report that has not happened in the past. The chances are greater for an oil mill to report having made either more or less oil per ton than to report having made the expected yield. Only recently has the tendency been that most mills report having made less oil than expected.

Previous discussion and remarks may be found in "Proceedings of Fifth Cottonseed Processing Clinic" pages 32 through 38. Either Mr. Gastrock or Mr. Garner may be able to supply a copy if you are interested. Also, I shall be glad to try and explain, at the time for discussion, how the net value per ton was calculated.

Briefly, because of others on this Panel, let us take a look at the data for 1955-56 as compared to 1954-55. First, at the bottom of the sheet you have, note that all three types of processing reported a lower efficiency than for the previous year. Only the hydraulic system approached its previous record.

Next under variation, for hydraulic, the average net value per ton is $1.22 in 1954-55 against $0.99 in 1955-56. This greater variation, in 1954-55, no doubt had a direct bearing on the average which was a positive value of $0.12 per ton as compared to a positive value of $0.22 in 1955-56.

Next under same heading, near middle of sheet, let us compare the results from screw press or/and expeller. The average variation for 1954-55 is $1.21 compared to $1.76 for 1955-56. The average net value per ton for 1954-55 is a negative figure of $0.15 as compared to a still larger negative value of $0.31 for the season 1955-56.

One more observation then I shall conclude. If you remember, our first objective was to try and find out if a direct relation existed between the moisture in the seed and a combination of the difference in calculated and actual yield together with the x value. From the data observed there is an indication that this is not altogether true. However, it does indicate the necessity of cooking the meats in such a manner that you balance the oil yield with the refining loss (x value).

If you were to plot the oil loss or gain against its x value the line will slope in a direction indicating that the more oil you make compared to the calculated yield the greater will be its x value. Still another way of expressing the same idea is - that the mill should ship in excess of calculated yield 2.4 pounds of crude oil (oil plus impurities) for each one point greater x value.

Conversely, if the mill is to operate at the same efficiency the x value should be lowered one point for each 2.4 pounds of oil reported less than calculated yield.

In conclusion it is my opinion that hydraulic mills may be operated with a greater degree of efficiency when the moisture content in seed is 11% or slightly higher. This is not entirely true when applied to screw press or and expeller operation. The reason for this difference could, I think, be in the method of cooking.

Thanks to each of you who has supplied information from which this data was taken. For obvious reasons your names are not mentioned.

HYDRAULIC

Moisture Range in Seed - %	Number of Mills Reported		Average Lbs. Oil Difference Act.vs.Cal.		Average X Value		NET VALUE Per Ton - Par Basis No Gain or Loss in Oil X Value = 3.6			
							Variation		Average	
	1954+ 1955	1955 1956	1954+ 1955	1955 1956	1954+ 1955	1955 1956	1954+ 1955	1955 1956	1954+ 1955	1955 1956
13.1-14.0	3	1	+1.17	-5.0	2.93	-0.50	+$0.246 + 0.348	0	+$0.314	+$0.484
12.1-13.0	7	1	+1.64	-1.0	2.64	1.30	+ 0.020 + 0.874	0	+ 0.394	+ 0.452
11.1-12.0	3	3	-2.50	0	2.16	1.73	- 0.420 + 0.632	+$0.140 + 0.828	+ 0.100	+ 0.415
10.1-11.0	4	10	-1.50	-3.77	2.37	2.02	- 0.900 + 0.916	- 0.392 + 0.620	+ 0.145	+ 0.020
9.1-10.0	13	8	-2.58	-0.60	3.11	1.79	- 1.032 + 0.575	+ 0.096 + 0.681	- 0.140	+ 0.374
8.1- 9.0	8	0	-2.50	0	3.16	0	- 0.924 + 0.296	0	- 0.140	0
7.1- 8.0	7	1	+0.11	-5.0	3.94	3.4	- 0.948 + 1.202	0	+ 0.169	- 0.452
6.1- 7.0	4	0	+0.75	0	0	0	- 0.256 + 0.696	0	+ 0.147	0
	49	24	SCREW PRESS, OR AND EXPELLER							
13.1-14.0	0	1	0	-5.0	0	2.0	0	0	0	-$0.116
12.1-13.0	0	2	0	-4.5	0	0.4	0	-$0.900 + 0.624	0	- 0.354
11.1-12.0	3	12	+2.0	-6.58	4.63	2.71	-$0.924 + 0.588	- 1.208 + 1.436	-$0.047	- 0.444
10.1-11.0	7	15	-6.12	-3.72	2.93	2.65	- 0.904 + 0.112	- 0.634 + 1.436	- 0.451	- 0.144
9.1-10.0	9	3	-3.26	-5.67	3.47	3.03	- 0.652 + 0.444	- 1.244 + 0.156	- 0.295	- 0.430
8.1- 9.0	10	1	-3.52	-3.00	3.75	4.6	- 0.788 + 0.158	0	- 0.388	- 0.540
7.1- 8.0	4	3	+3.55	-0.87	3.15	4.0	- 0.320 + 1.182	- 0.836 + 0.336	+ 0.463	- 0.180
	33	37								

(+) 2
% of Mills Reported (-) 2 Pounds Oil Per Ton (Range)

TYPE	YEAR	HYD.	S.P. - EXP.	SOLVENT
Season	1954-1955	51.0	29.25	78.6
Season	1955-56	50.0	13.50	60.0

Allen Smith
Jan. 1957

Mays: The subject of unexplained oil losses is not a new one. Records in our office covering the past twenty eight years will reveal that in every year these losses have occurred in some mills. Agriculture Information Bulletin Number 39 of the United States Department of Agriculture titled "The Grading of Cottonseed" covers a belt-wide survey of the cottonseed oil mills for a five year period (1942-43 through 1946-47). The average "oil unaccounted for" reported in this survey was 3.92 pounds.

Attempts at explaining these losses have been centered on an emphasis of proper and correct sampling. This is still as important as it ever was. At last year's clinic, the thought was introduced by several speakers that some of these unexplained losses or oil disappearances might be due to "bound" oil in the meal.

We agreed at that time to undertake further work on this problem with the methods and procedures reported by Fowler and Norris. In spite of limited personnel and a "busy season", we have devoted about four months to this problem, and this has entailed the extraction and treatment of hundreds of meal samples. These samples were secured from eight oil mills and covered by hydraulic, screw press and expeller operations.

Our early work on the method submitted by Fowler and developed by Miller bore out the caution expressed in his statement, that it was tedious and time consuming and subject to the formation of troublesome emulsions. For this reason the greater part of our work has been based on the use of an alcoholic extraction as suggested by Norris. Methyl alcohol was the solvent of choice but extractions were also made with isopropanol and S. D. Formula 30 alcohol.

Various methods of extraction were used to obtain the alcohol soluble material. Cottonseed meals which have been previously extracted with petrolic ether give an additional crude extract with methanol which may amount to 10-16% by weight. This crude extract was found to contain certain substances, now soluble in petrolic ether, and also, larger quantities of sugars and other unidentified substances not soluble in this solvent. The problem was to determine if these petrolic ether solubles were crude lipides.

It was apparent that these petrolic ether solubles contained something besides oil, so we resorted to a neutral oil determination to give us the answer. Repeated extractions and neutral oil determinations on the same stock of meal gave diminishing values, which led us to believe that this was due to the increase in free fatty acids in the meal on ageing. Some of the neutral oil fractions were checked for refractive index, iodine number and saponification value.

Even after treatment by the Official American Oil Chemists' Society method for neutral oil, some of these samples were still dark in color and seemed to contain some pigments and some very fine material in suspension. This gave a range of values for the constants determined which led to our next step, which was somewhat of a compromise of the approaches of Miller and Norris, and that was the determination of the total fatty acids in the petrolic ether solubles of the methanol extract.

We are not reporting the figures from this great amount of work because we do not feel that we have by any means arrived at a final method. Our work does lead us to believe that both hydraulic and screw press or expeller meals contain oil which can be released after further treatment

of the residue from the original petrolic ether extract. This additional oil will in some cases exceed the amount that may be said to have disappeared, and this would seem to bear out the statement of Fowler at last year's clinic, that the Official method for oil in cottonseed does not recover all the fat present in the seed. In other words, it may be that some of this additional oil, which is in excess of the "unaccounted for oil" was not chargeable to the mill in the first place. Of the meals tested, those of the hydraulic process contained less than the screw press or expeller types.

Finally, we are convinced that this is a complex problem that can best be handled in a research laboratory, and that its importance to the cottonseed crushing industry warrants its assignment as a project of the Southern Utilization Research and Development Division.

Brawner: I don't have a formal paper to present but I do have some data that we've gotten together recently and I think you may find interesting. Now we have hea rd that there are some unaccounted for losses, especially in screw press and expeller operations, because we have changed the screw press and expeller recently and some unusual losses have shown up at the same time. I've also heard that a lot of variations have occurred in the past in hydraulic operations. So we studied some data that we have, to see how much of our oil and seed could be accounted for. We took a number of mills, both hydraulic and expeller and took their clean-up results. I think all of you know what a clean-up result is. That's what you finally get out of what you bought, after you ship all your products. A statement of the facts was prepared showing how accurate our analytical work on sampling and clean-up results is on various expeller and hydraulic mills, going back over a period of as much as t en years in some cases. Now I am not very proud of some of the variations that are there, but I think everybody else has them too. We've had everything from a big gain to a big loss. In some cases we can explain them and in some cases we can't. Let me as a preliminary, tell you that a clean-up with us in our company doesn't explain every possible loss. If the clean-up is correct we probably should have a little loss that we can't explain, because we do not take into account that oil in the lint or the oil in the cleaning room trash, and you know that those two factors normally can account for three or four pounds when operating conditions are good. We have compared some clean-up results for hydraulic mills with those of the same mills after conversion to expeller or screw press operation. I'm using the expeller and screw press generally here, I know that the expeller means one type of machine and screw press another, but if I use one of these terms I don't necessarily mean the particular commercial machine referred to. Mr. Walton Smith has these data and I'm going to ask him to explain them to you.

OIL DISAPPEARANCE SURVEY

IN POUNDS PER TON OF COTTONSEED

	HYDRAULIC				EXPELLER OR SCREW PRESS			
MILL NO.	NO. OF SEASONS	MAXI-MUM	MINI-MUM	AVER-AGE	NO. OF SEASONS	MAXI-MUM	MINI-MUM	AVER-AGE
1	5	16.3	8.2	13.2				
2	5	9.5	(3.4)	3.4				
3	5	11.6	5.8	9.8				
4	5	6.4	2.1	4.7				
5	5	12.3	0.3	7.6				
6	5	15.6	7.1	12.4				
7	5	8.3	(1.7)	2.0				
8	5	3.2	0.3	2.3				
9	5	3.2	(4.2)	0.1				
10	5	13.6	(0.5)	5.3				
11	5	10.0	0.6	5.4	1	-	-	8.1
12	5	18.3	5.9	10.8	1	-	-	14.8
13	5	18.0	8.5	11.4	1	-	-	18.1
14	5	19.2	4.7	9.3	1	-	-	10.8
15	5	8.9	4.8	7.6	1	-	-	11.6
16	5	15.0	(2.2)	7.7	1	-	-	12.4
17	5	10.7	3.3	5.9	1	-	-	9.8
18	5	4.2	(0.3)	1.9	1	-	-	4.5
19	5	6.6	(0.3)	4.6	1	-	-	8.9
20	5	17.3	10.6	13.2	2	11.4	6.4	8.9
21	5	13.0	0.6	5.7	3	9.3	1.7	6.5
22	5	13.3	0.4	6.8				
23	5	11.1	2.0	5.5				
24	5	11.9	1.0	4.7				
25	5	13.0	(0.6)	4.5				
26	5	9.6	(4.7)	3.9	3	10.5	0.3	5.9
27					4	2.1	(1.1)	0.9
28	4	20.2	9.5	13.9	1	-	-	12.3
29					4	5.7	(1.1)	2.4
30	5	12.5	1.3	8.1				
		GRAND AVERAGE		6.8				9.1

Walton Smith: The figures presented in the table represent both hydraulic and screw press or expeller operations. The accumulation of data for hydraulic operation includes thirty mills and five seasons for most of the mills. The fifth season record for mill No. 28 was not available.

Both the maximum and minimum unaccounted for oil loss is shown, as well as the average for five seasons where available. There are variations of from a loss of 20.2 pounds to a gain of 4.7 pounds on hydraulic operations. The average for all thirty mills on hydraulic operation for the five seasons is 6.8 pounds of unaccounted for oil loss. The average loss on all the screw press or expeller operations is 9.1 pounds.

As a comparison for an individual mill, you will note that mill No. 11 has an average of five seasons of 5.4 pounds unaccounted for oil loss on hydraulic operation, and 8.1 pounds loss for one season on screw press or expeller operation. This is an increase in oil loss of 2.7 pounds. Most of the mills on which a direct comparison is available show the same type of loss increase. However, in mills No. 20 and No. 28 there was a reduction in oil loss. We feel that the results in these two mills may be accounted for by the fact that when they were changed from hydraulic to expeller or screw press operation there were also other major changes made in these mills.

Actually we think that the most representative mill would be No. 26, for which we have 5 seasons of hydraulic and three seasons of expeller or screw press operation which resulted in an increase in some kind of oil loss of two pounds. The difference between all the hydraulic and all the expeller or screw press mills for which figures are available is a 2.3 pound increase in unaccounted for oil loss.

Brawner: Now the 2.3 pounds that we show is probably a conservative figure because we have Mill No. 20, and I believe we have mill No. 28 that had gains, and from looking at the differences they range from about 2 to 4 pounds at mills that apparently had no special changes other than the changes from hydraulic to screw pressing or expeller operations. And it looks as though we might be getting approximately 2 pounds additional unexplained oil loss from this operation at the present time. But you can see that we have considerable variation and it is possible that something we're doing is causing it to show up this way. I might point out that mill No. 20 was the mill that was completely revamped, and had a very severe oil loss, and had other poor manufacturing results and consequently is not representative. Now mill No. 28 is another mill that is pretty interesting because it is a pretty good mill and in the past year for some reasons it has shown up with rather high oil losses that could not be explained. You will notice that for the maximum it showed 20.2, a minimum of 9.5 and an average of 13.9 on hydraulic operation. The one year that it did operate, it has shown up with a 12.3 loss, and it looks as though we might have a similar one or maybe a little higher one when we get our final figures in. Mr. Pryor has been working on this particular problem there and has been gathering some information. If Mr. Pryor is here will he please tell us about his work on this problem?

Pryor: Gentlemen, I would be glad to review briefly some of the work that we've done at the mill in question where we have tried to duplicate

the results that Dr. Norris mentioned last year in connection with the efforts that his company has made in accounting for the unaccounted loss in an expeller or screw press mill. Specifically, we have obtained daily grind samples from several different mills representing hydraulic, screw press and expeller operations. These samples were carefully mixed on a McClellan mixer and then divided into duplicates. One sample was run by the official method using petroleum ether for the extraction. The duplicate sample was run with a methyl alcohol extraction followed by a petroleum ether extraction of the boiled-off residue. As an example results of the mill in question where we've had high loss, the official method gave 3.26% fat compared to 4.79% for the methyl alcohol method. This represents a difference of 1.53% fat increase using the special method. Our data bears out the information that Dr. Norris mentioned last year but we didn't get as much difference as he indicated.

Information on a nearby hydraulic mill using approximately the same kind of seed gave a difference of 0.82% in the two methods of analysis. This would indicate in our case that the expeller mill had approximately 0.7% increase of the fat content by using the methyl alcohol method.

I believe that's about all the information that I can give at this time.

Brawner: Thank you. I might point out to you before I quit that the seed analyses do not seem to give us much trouble. We sample our seed as we buy them, as they come into the mill, and then we sample them again as we crush. And it's pretty unusual for us to have much variation between an average crush analysis and an average seed purchase analysis as far as oil content and protein content is concerned. They check out pretty well and in this particular case that Tom is talking about they check out almost perfectly. So we really don't know what's happening to us there. We had it before on hydraulic and we have it now on expeller. Maybe it's a little worse on expeller, I don't know. It looks like it might be. But we still have this peculiar situation that we can't explain. I might add that the scales have been checked, that the oil line has been checked, we've even had air put on them. The operations have been checked from one end to the other and we still can't find the cause of our trouble. And as you can see the extraction with methyl alcohol does not account for the pretty good difference that we might have.

Quinn: Thank you, Jim. I think Dr. Norris has some remarks he'd like to make. We're running a little late. I think that the subjects are of such vital interest that we'll all take the time. Dr. Norris.

Norris: The economic value of oil makes maximum oil recovery the primary objective of present day oilseed crushing. With this agreed the next question is, "How does one determine whether or not all available oil is being recovered?" Formerly, the oil content of meal produced and of oil lost in hulls through imperfect separation, have been the principal criteria. Especially do we all strive for low oil in meal and several improvements in equipment and in operating technique have made possible meals with oil contents less than 3%.

There has always been the question of under runs and over runs, but these have taken on more importance with present rather suddenly decreased oil in expeller and screw press cakes. If the expected amount of oil is

not obtained we tend to suspect the new equipment and/or operating techniques, and rightly so. However, we must be careful not to "overdrive our headlights", that is, to look for unusual explanations for things that may be readily explainable by the normal simple facts.

For example, we probably all differ somewhat as to how we determine our oil yields, and some of the differences could account for much if not all of our so-called "hidden oil losses". Remember that we are expecting a rather high degree of accuracy in our prediction of oil yields, yet techniques used may not be up to this standard. Few of us weigh our seed into process, relying instead on calculation from original seed receipts or daily production samples. Yet a true "material balance" as engineers call it, is based on accurately sampling, analyzing, and weighing all raw materials and end products.

I would like to bring up for your consideration here an outline of how expected oil yields may be estimated when seed is not weighed into process.

CALCULATING EXPECTED OIL YIELDS

1. Assumed Analysis of Daily Production Sample

Foreign Material	1.0%
Moisture	10.0%
Oil	18.5%
Ammonia	3.91%

NOTE: If seed has changed moisture during storage, these analytical figures will have to be corrected to take this into account.

2. Available Ammonia - 94% of 3.91 = 3.67

3. Total oil/ton of Cottonseed = 18.7% of 1980*# = 370.1#

4. 41% Meal/ton of Cottonseed = $\frac{3.67 \times 1980}{7.98}$ = 910 #

5. Oil Losses

   A. In Meal (assuming 3.56% oil in meal) = 3.56% of 910 = 32.4#

   B. In Hulls (assuming 0.39% oil in 474# of hulls/ton) = 0.39% of 474 = 1.9#

   C. In Lint (normal loss of 1# assumed) = 1.0#

   TOTAL 35.3#

6. Available Oil = 370.1 - 35.3 = 334.8 lbs.

* Allows for 1% foreign material in seed before cleaning and using cleaned seed for the daily production sample.

Quinn: First of all, Dr. Norris cautioned us to be critical in our approach to problems to make sure we do have losses, and yet Mr. Brawner's presentation did give figures to show that his company has experienced a loss which is not explained. I think, going back one step further, that there has been more discussion in recent meetings of this type about the analytical procedures that were utilized to predict oil yields and to determine the efficiency of the milling operations and just in my opinion, therein lies the whole thing. Most of the procedures that we've used were modifications of the old NCPA method. And of course, that is empirical. It certainly gave good results when we were on hydraulic operations exclusively, but when expression by more improved mechanical means came into the picture basic methods of performing our operations changed and therefore relationships which were valid then are no longer necessarily true. In the past three years that thought has come more and more to the fore point in my mind in listening to these discussions. I wonder if any of you gentlemen have anything to say along that line either in agreement or disagreement with me.

Allen Smith: Well, I can repeat what I said last year and that is that we have records of our operations, both at Perkins and W. Memphis and from 1947 up until the present time. We try to account for the oil in the lint, in the hulls, motes and grabbots; everything except the fly dust and the loose dust that we sweep out of the cleaning room. There is bound to be some fine meats and matter that we don't get because, like most mills, a truck farmer comes around and hauls the sand and dirt and burs away from our mills. We never have attempted to determine just how much oil there is in the sand and dirt and in burs hauled away in this manner. But, what brought this question of hidden oil loss or whatever you might call it, to my attention was the fact that in all the ten years that we have, as far as I'm able to calculate, a complete breakdown of our products received or coming into our mill, we've always been able to check within about and within less than 1% of our expected yields with the exception of three years, two years at W. Memphis and one year at Perkins. The year when we had an overlapping of one season into another we made 7-1/2 lbs. more oil than we expected. And in another year right close to it, we made about 7 lbs. oil less than we expected. That was on hydraulic.

When we put in the screw presses at Perkins they were started at mid-season and that year we pressed about 50% of the seed on hydraulic and the other on screw press and gained for that year 2.47 lbs. of oil, in other words, we shipped out that many lbs. of oil more than we had calculated. The following year, when there was 100% screw press operation, we shipped out only 1.35 lbs. less than we expected, which as you know is a pretty close analytical calculation. Operating a screw press is like riding a motorcycle. When I reached the point that I thought I was an expert on riding a motorcycle, that's when I had my downfall. And it may be the same way with the screw press operation because the following year we loaded up our cookers more, we used the maximum boiler pressure, and added water and live steam in the top kettle. In fact, the only limiting factor to the amount of water that we added in the top kettle was the opening between the top kettle and the second kettle, and when the meats got so wet and balled up they wouldn't fall through then we stopped the water in the top kettle. Then in order to get it out we

cooked hard and opened all the vents and on paper we were setting the woods on fire because we shipped out several tanks of oil around 2.4 to 2.5 refining loss. And for the whole season, I think, our loss was around 3.08. But when we wound up the season we came up with an oil loss of 12 lbs., and that shocked me into this discussion. About mid-season of last year 1955-56 we stopped cooking for one hour and a half (a good estimate). Right now we're using as little water as possible. We have all the vents closed. In fact, we have gone inside the 6-high cooker and stopped up the holes to the vent pipe with asbestos. Then I was thinking the other day it might be a good idea to go up on the roof and put a bucket over the vent pipe which we did and right now we're using as little water and as low a temperature as possible in cooking. In fact, for about a week there, we cut out steam in the bottom of the 4-high kettle trying to find a leak that I suspected and our temperatures fell down to about 225-230° and our extraction of residual oil did not suffer too much. At the close of this immediate season I hope that we will be over on the opposite side of the line from where we have been for the last ~~two~~ years.

Quinn: Thank you, Allen. Your remarks even more confirm the opinion I stated a moment ago. When we changed processing parameters radically by using more moisture, more temperature and so forth, we provided more room for deviations from the old analytical procedures. I wonder, Mr. Mays, if you have anything to say at this time? Do you disagree or agree with this?

Mays: Well, I can only partly agree with that. The thing that puzzled me throughout this whole thing, and I've said it several times, is that up until about 2 or 3 years ago we were able to check screw press and expeller operations in a great many cases just as closely as we did hydraulic using the same methods and analysis that we're using now. I can't help but feel that something has happened in the preparation or cooking in this more recent period that has changed the picture. We hope, as we promised, to do more work on this thing. I think this work belongs down here at this laboratory. They have the facilities to tell us whether this oil is bound, or oil that is being ordered that way, or whether some of this oil, as I said, is not chargeable to the mill in the first place. But I do know that one of the mills that Jim Brawner mentioned this morning, three years ago on their first year of expeller operation came out within one pound of their calculated yield. It has been done but it is not being done now.

Quinn: Yes, I recall some of them actually making more and I think there have been screw press operations that have.

I wonder if there are any questions from the floor that would like to be directed to members of the panel.

Pryor: I would like to ask Mr. Smith if he noticed any difference in the oil quality when he reduced the amount of moisture and the cooking time. I mean by that - refining loss, color and bleach, and so forth.

Smith: We don't determine bleach color. We do run refining loss, and I might say that we're not shipping any 2.4 refining loss oil. In other words right now our X value is in the neighborhood of 3 to 3-1/2 which means that we are using as little water and live steam in the top kettle as possible. In fact, our top temperature is 170 degrees in the top kettle. We use 20 lbs. gauge pressure on the top kettle, 20 lbs. gauge pressure on the second kettle, and 50 lbs. gauge pressure on the third and 60 lbs. on the others in a 6-high cooker, and our refining loss is up.

Pryor: It is some higher than it was?

Smith: It is some higher. But I'm trying to stay on that curve, hoping to make the pounds of oil that we should have. I can make an oil that yields a soapstock when refined in a cup that's so slick, you can ski around on it, or watery when you heat it slightly. I think you know whatI'm talking about. One of them will run high neutral oil and the other will run low.

Quinn: Do we have any other questions from the floor?

Bush: In this unknown oil loss, I wonder if anyone has checked the fine trash that seems to be dirt from the lint cleaning. If this is checked I believe the protein in this trash would sometimes run from 10 to even 14%.

Brawner: Yes, we've made some checks on flue bran and that doesn't account for the oil loss. We take all fractions of that type and put it in total bran and use that to bring our protein back down to the guaranteed analysis.

Quinn: Mr. Mays made a suggestion here concerning basic work on fat content of seed after expression or prior to expression. I wonder, Mr. Eaves, if you have any comments that you'd like to make concerning the Laboratory's long range plans or program on this subject.

Eaves: I can't say officially that the Laboratory has any plans of doing any work at this time, though I can see where it would be well worth while. I do have a question I want to ask both Mr. Mays and Mr. Brawner. Was the alcohol method applied to the meal residue remaining after determination of oil in the original seed? In other words was the oil that you found in the alcohol method charged to the mills initially?

Mays: No.

Eaves: Well, I think then that this needs to be determined before you can legitimately say that you're losing oil which was found by analysis. The fatty material which you are finding in the meal by the alcohol method may have been present in the original meats and not found by the petroleum ether determination, in which case the mills are not being charged for the oil that you are finding by the alcohol method.

Mays: That's exactly why I wrote that thing out and read it. I wanted the record clear. I said that it might possibly be that some of this oil is not chargeable to the mill but we are not saying that this oil is bound, and we are not saying that all of the oil is chargeable to the mill. We are saying that it appears to be more in some cases but we're drawing no definite positive conclusions on it.

Eaves: There was one other question I wanted to ask Mr. Brawner. You presented a list of mills which are having high oil losses. How does the refining loss of the oil produced in each of those high loss mills compare with the refining loss of the low loss mills.

Brawner: I can't answer that.

Eaves: The point I'm getting at is this. Why worry about trying to recover all of that oil that the analysis shows to be there when you're going to lose it in your refining. You get paid on the basis of your refining loss or the refined oil that you can produce from your crude. Isn't that correct?

Smith: Correct to a limited extent, but, in most instances when a mill reports having made less oil than the laboratory charges to the mill,

their refining loss or the quality of the crude oil that they ship isn't good enough to counterbalance the number of pounds loss that they report.

Eaves: I have some data that seem to indicate the same thing.

Smith: Yes, I think that's true.

Quinn: I'm sure there must be quite a few more questions.

Fincher: I'd like to direct this question to Mr. Eaves. From the analysis presented here we would expect about 2 pounds more invisible oil loss on the expeller than we expect on solvent extraction.

Now when you make a free fatty acid titration you are titrating free fatty acid, gossypol and phosphatides. Since gossypol has about twice the molecular weight of oleic acid, but has two reactive groups, titration of gossypol should indicate reasonably close to the weight of gossypol in the oil. Phosphatides have about three times the molecular weight of oleic and this would introduce some error, about 0.3%. I think this is borne out by a number of tests I've seen in which degumming reduced the apparent free fatty acids about 0.3%

Suppose a mill, and I am talking about solvent extraction now, determined the oil in seed going in and then titrated the fatty acid in the oil, then did the same thing with the oil going out. If the total amount of free fatty acid titrated in the oil going in were subtracted from the total amount of oil going in, and the total amount of fatty acid titrated in the oil going out were subtracted from the total amount of the oil going out, do you think it might be possible that a mill could get a reasonable balance on oil that way?

Eaves: You mean, would you have a reasonable approximation of the neutral oil content in and out. Well I'm not too sure about that. I think you'd have to run a neutral oil determination. The method we've been using lately for neutral oil determination is a modification of Linteris and Handschumacher's chromatographic method as developed by Mr. Hoffpauir and his coworkers and is simple and relatively rapid. I don't know that it's been published yet in complete detail. But almost any laboratory could adopt the method and determine neutral oil quite rapidly.

Quinn: I wonder if I might take a minute and make an attempt to sum up some of the points that have been brought out in this discussion and if I'm drawing conclusions or inferences that I should not I wish the other panel members would please stop me. First of all, Mr. Mays made the comment that there is something basic here. There appears to be no question but that we are experiencing oil losses in some magnitude which we cannot explain or rationalize and that being the case our analytical methods which we're employing to predict yields on seed and to evaluate milling efficiency leave something to be desired. Very likely, in order to overcome that problem, some basic work must be done in oil technology to determine what procedure can be used to determine more accurately the available oil, and that which has been expressed by the oil mill, to evaluate more accurately what the mill has done. The other losses in the mill, such as were mentioned in the cleaning room, linter room, and so forth, are a possibility, but very likely that possibility is much smaller and probably will not account for anything but a very small portion of the oil loss. Also, I think the changes in the front end of the oil mill in recent years have not been as great as the changes from the huller room on

through extraction. In that area we've probably done more and advanced more in the past ten years than in the other part of the mill. These seem to be the main points that were brought out this morning. I wonder before closing if any other panel member has anything they'd like to add to or subtract from my comments. If not, I'll turn the program back to Mr. Woodruff.

THE NEED FOR IMPROVING THE QUALITY OF CRUDE COTTONSEED OIL

By

P. A. Williams
Southern Cotton Oil Company

There are a multiplicity of factors which go to make up the quality of an oil. The most important of these are: (1) Loss on refining; (2) stability against oxidation; (3) bleach quality; (4) flavor acceptance; (5) flavor stability, and (6) potential color or whiteness after processing.

The trend in the industry has been to lighter finished oils and shortening for a number of years. This trend has placed cottonseed oil in a very unfavorable position, as its utilization has been, in some instances, by necessity, reduced. Economic factors have contributed heavily to this problem, but the inherent color in cottonseed oil has not helped its competitive position. Soybean oil and animal fats, the chief competitors of cottonseed oil, have, through improved processing and technological advances, improved, whereas cottonseed oil in general has been getting darker in color.

This has been brought about by a switch in processing from the hydraulic method to solvent, pre-press solvent, and expeller methods. It is generally known that screw-pressed oils are normally darker in color, and tend to revert in color to a greater degree than hydraulic-pressed oils.

Realizing this restriction, the cottonseed processing industry has been improving procedures which in numerous instances have been successful in improving this condition. The refiners of oils are taking advantage of new and improved methods of refining to improve color. New and improved methods for re-refining cottonseed oil have reduced the loss to a minimum as compared to the old conventional procedures used for years. This re-refining loss, even though small, necessitates an added operation which is not necessary when using soybean or animal fats.

The refining loss of cottonseed oil is on the average much higher than soybean and animal fats. Some of this difference is brought about by unfavorable weather conditions prior to harvesting the cottonseed, as well as deterioration in storage. Degumming of soybean oil by conventional methods has lowered its refining loss. Evidence will be presented which shows average comparative refining losses of soybean oil and cottonseed oil with the same free fatty acid content.

REPORT ON COTTONSEED MEAL FEEDING TESTS

By

V. L. Frampton
Southern Utilization Research and Development Division

Commercial cottonseed meals vary widely in their chemical properties such as protein solubility, gossypol, lysine, or sugar content. This is true of cottonseed meals which are produced at different mills with the same type of equipment. This variation is reflected in the growth response of broilers fed on rations containing such cottonseed meals. With respect to the meals themselves the correlation between protein solubility and total gossypol is very poor; the same is true for protein solubility and bound gossypol. The odds for significance of a correlation between bound gossypol and lysine content of the meals are 200:1, while the odds for significance of a correlation between protein solubility and lysine content of the meals are only 24:1.

The agreement between stations in weights of chickens at 4 and 8 weeks on a given ration was very poor, while the agreement in the alignment of the several rations at each of the various stations was good.

The growth response of the chickens was found to be correlated negatively with the total gossypol and with the crude fiber content of the rations. The correlation of the growth response and the lysine content and with the energy of the rations was positive. No correlation was found between the "free" gossypol of the rations and growth response of the chickens. The solubility (in 0.02 N NaOH) of the proteins in the rations is correlated with the growth response of the chickens.

The growth response of the chickens on most of the rations containing cottonseed meal was not as good as that shown on the control ration. A portion of the reduced growth response is probably attributable to the high crude fiber content (largely cottonseed hulls) of the rations containing the cottonseed meals.

At a meeting held at this Laboratory in Nov., 1955, it was decided that 8 cottonseed meals, representative of all commercial processing methods, were to be selected for this collaborative study. Cottonseed oil mills throughout the country were contacted and requested to send one pound samples of meal typical of their daily production to us for analysis. Some 50 odd samples of meal were received. Those samples were subjected to 4 screening analytical procedures, involving analysis for contents of free gossypol, total gossypol, total nitrogen, and soluble nitrogen. A very wide variation was found in the content of meal constituents prepared by different processing methods. From the results of that screening test, 8 meals were selected to be used as most representative of the types of meals produced by each cottonseed processing method employed today.

The mills producing the selected sample types were contacted, and a certain portion of their daily production was set aside and then forwarded to St. Louis where the actual mixing of the rations took place. The meals shipped to this central mixing point were then incorporated with a basal chick ration in order to make a practical broiler ration. Each cottonseed meal was tested at three different levels in three different types of ration;

(1) ration type #1, the cottonseed meal contributed 100% of the supplementary protein of the ration; (2) for ration type #2, the protein supplement of the ration consisted of 75% cottonseed meal and 25% soybean oil meal; (3) for ration #3, the protein supplement consisted of a 50:50 ratio of cottonseed meal to soybean oil meal. The soybean oil meal had been supplied by the Soybean Oil Meal Association; this meal was used also for the control ration in which it contributed all of the protein supplement.

After the rations were mixed, samples of each were supplied to various collaborators who were going to conduct the actual chick feeding studies for 8 weeks feeding time in 3 different trial runs. Samples of the selected cottonseed meals and the control soybean oil meal were supplied to other workers for studies with swine, rats, dairy and beef cattle, lambs and laying hens. Samples of the selected meals and final rations were also analyzed for the following contents: total nitrogen, nitrogen soluble in 0.02 N sodium hydroxide, moisture, oil, iodine number of the oil, crude fiber content, total phosphorus content, inorganic phosphorus, total sugars, reducing sugars, lysine, free gossypol, and total gossypol. The results obtained from the chemical and feeding studies will be subjected to complete statistical analyses.

By means of the Moore and Stein ion exchange procedure for amino acids, the lysine content of the series of cottonseed meals used in the nutritional experiment were determined. A variation in the lysine content of commercially produced cottonseed meals was observed. Processing obviously affects the lysine content of the meals, but the variations in operating any given process are so great that simply naming the process is not sufficient for characterizing the meal.

In the same manner the lysine content of the diets used in the experiment were determined. A definite correlation between the lysine content of the diets and the growth response of the chickens was noted.

THE NEED FOR IMPROVING COTTONSEED MEAL QUALITY

By

A. M. Altschul
Southern Utilization Research and Development Division

There has been a great change in the practices and in types of animals raised in the United States since cottonseed meal was first produced. Then the major industry was the beef and dairy industry, mixed feeds were uncommon; most of the mixing and feeding was by the farmer or rancher himself. The complexion and practices of feeding in the cotton-producing states have undergone marked changes in recent years. Poultry raising has become a great industry; over 50% of the broilers are raised in the cotton-producing areas. Mixed feeds now are the largest consumers of feeds in the country. The raising of nonruminants, such as poultry and swine has assumed enormous proportions; actually there has been a sensational rise in the amount of poultry grown in the United States in the last five years.

Our understanding of what we can and should do with cottonseed meal must take heed of these developments and must accommodate itself to these changes. Cottonseed meal is a high protein feed and the quality of the protein is good. It should be used to the best advantage and only then will it furnish the greatest economic return. Cottonseed meal has great potential as a supplement in poultry and swine rations where it can complement the value of soybean meal, and together the two can furnish an excellent ration. Papers given at the Fourth Meeting on Cottonseed Processing as related to the Nutritive Value of the Meal which was held January 14-16, 1957, have provided testimony to the fact that cottonseed meal can be produced for these purposes and can be used in nonruminant feeds. It is estimated by commercial sources that approximately a million tons of cottonseed meal go into mixed feeds, of which approximately half or 500,000 tons go into nonruminant feeds such as feeds for poultry and swine.

We have by no means reached the limit of what we can do with cottonseed meal. As the conference pointed out, there is considerable room yet for improvement in cottonseed meal for poultry and swine; there is evidence that there are means of making it possible for cottonseed meal to be fed to laying hens and there was shown the relationship between protein quality and toxicity of cottonseed meal for swine which should greatly improve the chances for increasing the amount of cottonseed meal used in that field. Moreover, there are developing certain chemical measures such as measure of lysine which promise to be helpful to the processor and feeder to produce and use the best possible meal.

PROCESSING AND PRODUCT QUALITY

Panel Discussion By:

H. D. Fincher, Moderator, Anderson, Clayton and Company, Houston, Texas
James Hickey, Armour and Company, Forrest City, Arkansas
John Howard, Southern Cotton Oil Company, Cullman, Alabama
J. B. Perry, Jr., Mississippi Cottonseed Products Co., Grenada, Miss.
P. A. Williams, Southern Cotton Oil Company, New Orleans, Louisiana
A. M. Altschul, Southern Utilization Research and Development Section, New Orleans, La.
V. L. Frampton, SURDD, New Orleans, La.

Fincher: Logical improvements in cottonseed oil quality would include refining loss, color and keeping quality or flavor stability. Reduction in refining loss means greater return to the processor. The refining loss can be reduced by storing and processing to minimize FFA rise and to minimize impurities in the crude oil. Color improvement will place cottonseed oil in a better position for competing with soybean and other light oils. Again we must look to storage and processing conditions which reduce the pigments responsible for initial color and for color reversion. Other possibilities are new refining methods and new chemicals for removing color from the oil.

Refining, hydrogenation and deodorization can upgrade oils of low quality. However, these steps do not completely eliminate the effects of

prior oxidation. Undue exposure of the oil to atmospheric oxygen and other conditions which favor oxidation should be avoided. Contact with copper, brass or bronze valves and fittings allows the formation of copper soaps which are potent catalysts for oxidation.

Quality improvement will place cottonseed meal in a better competitive position with other protein sources.

Points to be considered in improving meal quality include:

1. Protein solubility and/or lysine availability.
2. Free and total gossypol content.
3. Appearance.
4. Production of high protein, low fiber meals for poultry feeds.
5. In the case of solvent extracted meals, the problem of dustiness.

Study and adjustment of processing conditions would seem to be the logical approach to improving protein quality.

Gossypol can be reduced by proper processing but it appears that chemical treatment will be required if we are to reach our goal. Free gossypol must be eliminated if we are to have unrestricted use of cottonseed meal in all mixed feeds. At least some types of bound gossypol seem to be objectionable from the standpoint of reduced availability of amino acids. We can probably take some lessons from the soybean industry in the screening and grinding operations for improving the appearance of our product. The possibility of converting at least part of our production into high protein, low fiber meal for use in poultry feeds should not be overlooked. The dust problem has been overcome to a large extent by the use of additives. Some users like the additional fat contributed by these additives. Dustiness could also be controlled mechanically by separating and reprocessing the very fine fraction of the meal.

<u>Howard</u>: We are familiar with the ways to handle the big things in the operation of an oil mill. If a superintendent is asked about the cooking procedure in his mill, he can tell you. He can also tell you how seed are handled in storage, how his linters are set and what his yields are.

There are a lot of small things in an oil mill that affect efficiency of operation, yields and quality of products. These small things quite often exist from year to year because:

1. They are not seen or brought to the attention of the superintendent.
2. Everyone is too busy working on the big items.
3. Some expense is involved in the correction.

These remarks are not intended to be criticism. I am just as guilty as anyone about not taking care of the small things. It appears worth while to make a quick trip through the mill to discuss some of the little things.

Does your unloading and seed handling equipment crack up cottonseed? A plough not made right or correctly set on the distributor belt in the top of the seed house may mash enough seed to cause later trouble in storage, in separation, or even in the press room. Is the conveyor to the mill from the seed house equipped with a perforated bottom? If the conveyor screw is set too close to the perforations some hulling may occur. Then, of course, meats go out in the cleaning room trash and oily lint and poor separation occur.

What becomes of the fiber from the pneumatic seed unloaders and seed cleaners? If this can be collected to incorporate with motes, a better quality mote is obtained and fiber is recovered from trash.

Suppose you have your linters properly set and are making as good lint as possible. What happens when the weather turns cold? The lint room people close all the windows and doors. The fans do not pull enough air causing improper linter operation, more motes are made and the operators are just as cold as they would be with the windows open. Some means should be provided to furnish the lint room with enough air with all the windows and doors shut.

Are you troubled with poor separation? Maybe you do not have enough shaker surface or the right perforation sizes. Maybe the hullers are not running the right speed or need working over. Maybe the recycles of uncut seed is too large. Recently one mill operating on good dry seed found that it was necessary to speed up and close up the hullers, blank off part of the top shaker surfaces and use a little steam on the black seed to accomplish the desired results.

Little things in the press room can make operation easy or hard. Does the meats bin bridge when it is filled up? Maybe the design needs changing or maybe the bin needs to feed the rolls instead of the cooker. Do conveyors handling cooked meats bridge over feeders causing uneven flow and lost time by the operators poking around in the spout to break the bridge? Maybe the spout needs to be larger on the bottom than the top or maybe it needs what one superintendent did. He stopped all this trouble by cutting the flight of a 12" conveyor over a feeder back to about a 3" projection and attaching 3 spikes on the conveyor shaft to turn in the opening. The spikes extended to just clear the conveyor box.

Do you operate second hand expellers? Maybe you have the wrong type conditioner shaft to give you a steady feed. The manufacturers are very good about helping everyone to get the proper equipment to work with an installation. They probably told you that the type agitators on your conditioner shaft would work but that the adaption for cottonseed would work better. They are 100% right. You will find that the proper arrangement on the conditioner shaft will give you a better expeller operation.

Do you get oil vapors from the filter press settling on the walls and collecting dirt? Does foam and filter press cake get in the filtered oil trough to make a mess all around and put meal in the storage tanks? Two superintendents that I know have made manifolds to replace the filtered oil troughs. The manifold is connected to each filter plate outlet with surgical or tygon tubing so that the oil may be seen as it is filtered. This is a much cleaner operation than the usual one.

Another item that gives a steadier feed to an expeller is the correct transmission on the feeder to the conditioner. A steadier feed will be had if the feeder gear revolves nearly a complete revolution when the machine is under full load. A variable speed constant drive would be better still.

Everyone knows a cooking procedure that seems to give the best results on either hydraulic or mechanical press operations. There are a few little things that can possibly improve the work. More agitation may be needed. If this is the case the cooker sweeps can be put back in shape and spaced properly from the cooker bottom. Possibly the cooker shaft needs speeding up. On a continuous cooker operation the cooker may be batching.

One superintendent caught all these conditions, corrected them and recovered 6 to 8 pounds more oil per ton.

Attention to the little things in a hydraulic press room operation may mean the difference between good work and bad. Some of the items to be checked are:

1. Condition of press cloths.
2. Uniform spacing of press boxes to make uniform sized cake.
3. Speed of uniform travel of presses from closing of valve to maximum pressure.
4. The manner in which the presses are loaded. Each press should be kept down for the minimum time for unloading and loading. Some of the best press room work noted was in a press room so crowded that only one press at a time could be worked on. This kept the cake pullers from getting ahead of the press chargers.
5. Operation of the former and cake buggy.

The handling of motes and trash in the average mill can be a pretty big item. Fiber, meats and seed can be hauled off, thus increasing the working loss and adding to the labor cost. A little thought given to this problem may bring out ways to recover products and to reduce handling.

Cleanliness around any mill is a major problem. Although a major problem, it is a composite of little things. Undersized dust collectors will make a mess. Covers on bins and supply tanks will help keep the dust down. An overflow opening on a conveyor or rotorlift will distribute products all over the place unless the opening is equipped with a spout. If the wash room looks dirty and messy to you everytime you pass by, maybe you should give someone on each shift a regular schedule for cleaning it and maybe you should pass some rules - and enforce them.

It is believed that some attention to the little things around a mill will complement the big things to make a smoother operation and to recover more products.

Perry: I would like to agree with what Dr. Altschul said. I believe there's a very definite correlation between the quality of the meal and the quality of the oil. I won't make a positive statement, but I definitely believe that there is some damage to the meal at high temperatures and also some damage to the oil. As to what extent, I don't know, but I think maybe we've gone a little overboard on high temperatures on screw press operation which has done some damage to the oil and I'm sure that we've done similar damage to meal, so far as the soluble proteins are concerned.

Hickey: I have a question to direct to Mr. Williams. The color reversion, I understand, is greater in expeller oil when compared to hydraulic oil. Now is that caused by heat or something that we do to the gossypol in the cooked meats, or is it a combination of the two things.

Williams: Frankly, I don't know. The only thing that I can go by is the results in the charts that I presented, which show a disappearance of the gossypol within the oil itself and an accelerated reversion, and the greater the drop in gossypol content of the oil the greater the increase in color. I believe that you do get some deterioration in bleach color by overheating and oxidation. In most cases the hydraulic oil exhibited the best bleach colors, but we have had expeller mills in the same vicinity,

and even in the same mill working the same season, that produced oil that was equal in quality. Generally speaking, the way that hydraulic oil is processed does tend to reduce the gossypol content of the oil itself.

Perry: I'd like to ask Dr. Altschul one question. In checking the nitrogen solubilities of the cottonseed meals, were there observed any visual color differences? I think something of this sort may be interesting because meals heated the most, appear to be darkest colored.

Altschul: We did try some work along that line, because it is the sort of thing one might expect in studies of nitrogen solubilities. However, in spite of the fact that the darkest colored meals have generally been overheated, not too many conclusions can be drawn on the basis of the colors of the meals. I'm afraid that color measurement is not a reliable index.

Fincher: In hydraulic-press operations, most of the gossypol is bound in the meal during the moist-cooking operation whereas most of the gossypol is released from ruptured pigment glands during the screw-pressing of the low-moisture cooked cottonseed meats; for that reason one could expect less gossypol in hydraulic-press oil and more gossypol in screw-press oils. I think it is an accepted fact that gossypol is responsible for a lot of the color reversion which occurs in stored crude cottonseed oils.

Altschul: I'd like to comment on Porter Williams's interesting talk. The thing that struck me as very interesting was the fact that during deodorization of soybean oil the oil color is generally reduced, whereas in deodorization of cottonseed oil the color is not reduced and may even be increased. Would you care to comment on that point, Mr. Williams?

Williams: I might say that deodorization was more effective in reducing the final color in the case of soybean oil. There is also a tendency for oils coming from a deodorizer to revert to a slightly darker color upon cooling. However, this tendency toward color reversion upon cooling is more prevalent in the case of cottonseed oil than with soybean oil. I might say that there have been some advantages in re-refining methods for improving the color and the bleach color of cottonseed oil which does put it in a much better competitive position than it was several years ago. However, it still means that you get a half of 1% loss. With an added operation you are not always able to produce an acceptable color by re-refining. For instance you can take oil with a 5 bleach color and you can refine it, re-refine it, and re-refine it, but there is a limit to which you can go in reducing that color. You reach the law of diminishing returns. Frequently, you can take a soybean oil that you bleach down to 3 red and it will come out of your deodorizer with a .5 or .16 color, which is unheard of in the deodorization of cottonseed oil. Believe me, I'm a cottonseed man and have not seen this happen. We can't stick our heads in the sand to solve these problems.

Frampton: I think that gossypol isn't the only contributing factor to color. Certainly, there are many reaction products formed during processing which may contribute to color. In the case of gossypol, speaking of our own recent experiments in the laboratory, gossypol becomes fixed in the oil; this fixation occurs very rapidly in the case of crude oil. In the case of refined and bleached oils, the disappearance of gossypol isn't so rapid, but it does disappear. That is, it can't be extracted from the refined, bleached oil. It becomes fixed and cannot be removed by

refining or bleaching. The interesting thing is that as this oil stands the color will become orange and then red and the rate of transition seems to be a function of temperature. Now we don't know what the mechanism of transformation to bring about the fixation of the yellow color or the change from yellow to red fixed pigmentation involves. It seems quite probable that the reaction involves an esterification between gossypol and oil triglycerides, and secondly, the gossypol-fatty acid ester formed undergoes more change to yield the red fixed pigments. The red coloration products produced in this way are not amenable to removal with alkali-refining and bleaching. It doesn't matter how many times the oil is re-refined. The red color remains intact and cannot be removed.

Fincher: Do we have any questions from the floor?

Brawner: I noticed that Dr. Frampton stated that crude fiber, total gossypol and lysine contents affected meal nutritive value. Was nitrogen solubility involved?

Frampton: There is a correlation between nitrogen solubility and the nutritive value of the meal. But that correlation is not as good as the correlation between nutritive value and any one of the other three factors put on the board. I won't go into a discussion of solubility largely because of the limitation of time. But I think that for our purposes in trying to find out why we have the variation in cottonseed meals and why they're not as good, we ought to strive toward those things that have a real meaning. The alkali solubility is an empirical and arbitrary value. Now it turns out that you get an equally good correlation between nutritive value of cottonseed meal and its solubility in sodium chloride solution, or in hydrochloric acid. But it is very difficult to interpret or correlate these data in terms of the response of the chicken. Now in the case of lysine and in the case of crude fiber, we can very definitely say that there is a real correlation.

Brawner: Thank you, but can you explain that just a little bit further. Have you determined multiple correlation values in order to estimate the relative importance or weights of these different factors on nutritive value?

Frampton: Statistical analyses of all data from the cooperative feeding study have not been completed. So all conclusions to date are preliminary in nature.

Brawner: In other words, you don't know whether that's 50% or 90% for the whole group?

Frampton: I'm not sure that your question is clear to me. These are the factors that we found in an analysis so far as they have been carried out at the present time. They're important and the relative importance is given by the coefficients. In other words, the total gossypol is something like 50 times more important than the crude fibers.

Brawner: Thank you very much.

Frampton: I want to emphasize, however, that these conclusions are preliminary. We haven't completed statistical analyses of all data. These are all the indications at the present time and it might very well be that they will have to be revised somewhat or maybe extensively by the time that the complete analyses are in.

Smith: In relation to Dr. Frampton's talk, I get the idea that lysine and nitrogen solubility may be more or less tied up. Is that true or is that not true?

Frampton: I don't know. There are correlations between lysine and nitrogen solubility, but the correlation isn't one to one. I don't remember what the value is, but I think the correlation coefficient is something with the odds of significance, say, of only 30 to 1. And the same thing is true with the correlation coefficient between nitrogen solubility and total gossypol. There is a correlation between the total gossypol and the nitrogen solubility but it is very low.

Quinn: We produce meal in which we can control the gossypol content by chemical treatment. The occasion has been presented to me to notice the gossypol in the seed from year to year. I'd like to direct this question to Dr. Altschul. Has there been any attempt to correlate natural gossypol in seed by a breed type or by seed classification?

Altschul: I don't know if Mr. Hopper is in the audience because he could answer the question much better. But Mr. Hopper and his associates made quite a study of the variation in gossypol content of seed from various parts of the country and found there were differences in gossypol contents. Differences attributed to variety and environmental conditions. For example, certain California seed has a total gossypol of about 0.7%, whereas we have received seed containing 1.25 or 1.3% gossypol from other parts of the country. You might also be interested in the fact that certain geneticists are trying to breed out gossypol or reduce it. That's a very worthwhile idea except that one has to remember what Dr. Goheen pointed out yesterday. He stated that the contribution of cottonseed to the value of the cotton crop is between 10 and 15%, and you can't breed gossypol out of the seed unless you are very sure that it will not affect quality or yield of the lint. So I don't think that one should take too much stock in the future of experiments along those lines because of the tremendous things that have to be overcome. But that's certainly an approach. Do you want to say something on that, Bill?

Coleman: I just wanted to say that there is a paper published giving that data in the journal. I would like to direct a question to Dr. Altschul more in self defense than for any other reason. I would like to learn in just a general statement the difficulty of turning lysine determinations into something which the mill operator can run as easily as he did nitrogen solubility determinations.

Altschul: I think that's a wonderful question, Bill, I can just see what you've got in mind. I imagine that everyone of your people will be sending in notes next week, "Bill, run the lysine content." I think it would be a good idea on the tour that you take this afternoon, Vernon, that you show them the equipment that is used for lysine. It might interest you people to see it. The method for lysine determination is a chromatographic procedure developed by two people at the Rcokefeller Institute for Medical Research. The method is quite time consuming. I think it takes from 1 to 2 weeks to run a complete analysis on the meal. However, since it takes 1 or 2 weeks a meal, you might be able to run 10 or 12 at a time. I'll tell you that is a problem that's worrying us, because we believe that this lysine thing is much more important than any other variable concerned with meal nutritive value. Brawner, I'd like to clear up a point. What you're getting here is the end of one and the beginning of a new one and of course that's a point of confusion. Up until now, the only measurement that we had worth anything to you was nitrogen solubility determination. We never liked it from the very beginning but it was the best thing we had and is

still the most reliable thing. Don't let anybody throw it out yet. But we're looking for better methods and that's what Dr. Frampton is trying to point out and I think that was the point you were trying to clear up. We are working very hard at the job of trying to get a rapid lysine method. As a matter of fact, one of the NCPA fellows, Mrs. Conkerton, is working on something that she and Dr. Frampton have proposed and we're rather optimistic but that's all. We won't say how long it will take us to get it. But don't go around sending us or Bill Coleman samples for lysine determinations because goodness knows how long you're going to have to wait.

Milligan: I was just wondering whether there wasn't a point on lysine, I speak now as a student learning, and I wondered whether perhaps there wasn't a relationship between lysine and nitrogen solubility in terms of available lysine. I wondered whether perhaps really available lysine isn't the thing we're actually after, because when we deal with lysine we have actually a portion that is not readily available for chicken and for swine and we also have a portion that is readily available. Perhaps part of the confusion lies in just that point. Would you care to comment on that, Dr. Frampton?

Frampton: The lysine values we used in computing data from nutrition study were obtained with acid hydrolysates of the meals. It might very well be that there is a question of what is available lysine. There is a lot of fog around that because what do you mean by available lysine? It might very well turn out to be that the gossypol in these cottonseed meal rations may affect lysine content. It could be, for example, that the gossypol is combined with lysine. Therefore, in those meals which have a high total gossypol content, the lysine that remains in the meals after processing may be tied up with the gossypol and less available to the animal. This might be the answer there.

Fincher: Any further questions? Would anyone in the group like to make any comments?

Howard: What is the nature of the unsaponifiable matter in oil?

Altschul: That's a good question and I'm sure that people like Porter Williams here know infinitely more than I do on the subject. I might say that there is a growing interest in our group and in many other groups on the nature of those materials in cottonseed oil that cannot be accounted for as glycerides. I might point out, for example, that we're interested in the Halphen acid which is the acid that is believed to cause pink albumins of eggs from hens fed cottonseed fats. It has not been characterized, There are certain phosphitides and steroids in cottonseed oil that we don't know too much about. I would say that we haven't learned much more about them in recent years. We are investigating the Halphen acid and plan to work with other minor oil constituents.

Fincher: I would just like to make one comment to settle Mr. Quinn's question. I realize, Dr. Altschul, what you said about breeding gossypol out of the seeds that you'd have to think of other things and I've even heard it said that if you breed the gossypol out of the seeds they are sterile, I don't know if that's true or not, but I am a little hopeful that we can get some help in that direction and the reason I say that is we attribute some of the relatively low gossypol content meal used in California, Arizona and areas with a lower gossypol in the seeds. Are there any other questions or comments?

Easley: I'd like to direct a question to Dr. Altschul as to the effect of moisture in cooking. What is the maximum amount of moisture?

Altschul: That's a difficult question, but I think that in general we might say that if you have a higher moisture content at cooking the chances are that you have more protein damage than cooking at the same temperature but with a lower moisture content. Now there have been attempts to reduce the gossypol in seeds by cooking, moist cooking, and you can do it. You can take seed and cook it with a high moisture content, say about 15% or 18%, and you can get the free gossypol down quite a bit. I believe Carl Lyman did that over 10 years ago, but unfortunately when this is done the protein value is destroyed. Now I don't say that you couldn't find a time-temperature-moisture relationship that would work good at high moisture as well as at low moisture, but at high moisture you would have to have a shorter timing or a lower temperature.

RESOLUTIONS

February 5, 1957

The following resolutions were presented by Messrs. J. B. Perry, Jr., J. R. Mays, Jr., and R. F. Patterson to the Association, and they were unanimously adopted:

Resolved by those in attendance at the Sixth Cottonseed Processing Clinc held at the Southern Utilization Research and Development Division in New Orleans, Louisiana, in cooperation with the Valley Oilseed Processors' Association, February 4-5, 1957:

That we extend to Dr. Fisher and the Staff of the Southern Utilization Research and Development Division our deep appreciation for the fine conference just concluded and the many courtesies extended to us during this conference including the making of hotel reservations.

We wish to thank the Staff of the Laboratory for the particular work done on use of linters in high quality paper manufacture and urge that work continue in this field; also for the work being done on cottonseed cleaning and urge that this work be continued for it is our belief that these programs will ultimately result in producers of cottonseed obtaining more value for their product.

Research that has been conducted by the Southern Utilization Research and Development Division on the improvement of the quality of cottonseed products has been of great benefit to the farmer, to the consumer, and to the oilseed processing industry, and we urge a continuation of this research work.

With the increased complexity of oil mill technology, it is necessary for oil mills to conduct their operations in the most efficient and economical manner. To this end a complete material balance between the consituents of purchased seed and manufactured products is of utmost importance. We strongly urge and recommend the adoption of this project by the Southern Utilization Research and Development Division.

The Sixth Cottonseed Processing Clinc extends its sympathy to James J. Spadaro who was not able to appear on our program due to the serious condition of his father, as a result of an automobile accident in Florida and it is our sincere hope that his father's condition will steadily improve.

Signed: ______________________

RESOLUTIONS COMMITTEE

J. B. Perry, Jr.
J. R. Mays, Jr.
R. F. Patterson

APPENDIX

P R O G R A M

THEME: A CHANGING INDUSTRY AND ITS PROBLEMS

February 4, 1957 - 9:30 a.m.
Auditorium - Third Floor — Chairman, E. F. Pollard, SURDD

1. Opening Remarks - C. H. Fisher, Director, SURDD

2. Response - R. F. Patterson, President, VOPA

Part A. Progress Reports on Utilization of Linters

3. Making the Best Use of Linters Standards.

   a. Marion Whitten, AMS
   b. M. H. Fowler, Buckeye Cellulose Corp.
   c. Thomas M. Gluyas, Mississippi Cottonseed Products Co.

   Intermission -

4. Progress in the Development of Improved Seed Cleaning Equipment.
   L. L. Holzenthal, Engineering and Development Section, SURDD

5. Panel Discussion on Linters.

   E. A. Gastrock, Moderator, Head, Engineering and Development Section, Southern Utilization Research and Development Division
   M. E. Whitten, Agricultural Marketing Service, Washington, D. C.
   M. H. Fowler, Buckeye Cotton Oil Company, Cincinnati, Ohio
   T. M. Gluyas, Mississippi Cottonseed Products Col, Jackson, Mississippi
   L. L. Holzenthal, Southern Utilization Research and Development Division
   Richard Hall, Agricultural Marketing Service, SURDD

   Luncheon - Laboratory

Part B. Industry Trends and Research Needs

6. The Implications of Present Trends in the Industry on Processing Methods and Quality and Utilization of the Products.
   E. A. Gastrock, Engineering and Development Section, SURDD

7. New Crops and Crop Shifts.
   T. H. Hopper, Analytical Physical and Physical Chemical Section, SURDD

8. Research Needs.

   a. H. L. E. Vix, Engineering and Development Section, SURDD
   b. F. G. Dollear, Oilseed Section, SURDD

9. High Protein Meal.

   a. The Effect of High Protein Meats on Press Room Operations.
      L. C. Roots, Anderson, Clayton & Co.
   b. Markets for High Protein Meal.
      J. L. Milligan, Ralston Purina Co.

10. Panel Discussion on Industry Trends and Research Needs.

    G. E. Goheen, Moderator, Assistant Director, Southern Utilization Research and Development Division
    E. A. Gastrock, Head, Engineering and Development Section, SURDD
    T. H. Hopper, Head, Analytical, Physical and Physical Chemical Section, SURDD
    H. L. E. Vix, Engineering and Development Section, SURDD
    F. G. Dollear, Oilseed Section, SURDD
    L. C. Roots, Anderson, Clayton & Company of Mexico, Mexico, D. F.
    J. L. Milligan, Ralston Purina Company, St. Louis, Missouri

February 5, 1957 - 9:00 a.m.
Auditorium - Third Floor

Chairman, Ralph Woodruff
Program Chairman, Allen Smith, VOPA

Part C. Processing and Product Quality

11. Can Neutral Oil Yields be Used as a Basis for Evaluating Oil Mill Operations:
    P. H. Eaves, Engineering and Development Section, SURDD

12. Panel Discussion on Hidden Oil Losses.

    W. G. Quinn, Moderator, Buckeye Cellulose Corp., Memphis, Tennessee
    Allen Smith, Perkins Oil Company, Memphis, Tennessee
    J. R. Mays, Jr., Barrow-Agee Laboratories, Memphis, Tennessee
    F. A. Norris, Swift and Company, Chicago, Illinois
    J. H. Brawner, Southern Cotton Oil Company, New Orleans, Louisiana
    P. H. Eaves, Southern Utilization Research and Development Division
    Walton Smith, Southern Cotton Oil Company, New Orleans, Louisiana

13. The Need for Improving Cottonseed Oil Quality.
    Porter A. Williams, Southern Cotton Oil Company

    Intermission -

14. Report on Cottonseed Meal Feeding Tests.
    V. L. Frampton, Oilseed Section, SURDD

15. The Need for Improving Cottonseed Meal Quality.
    A. M. Altschul, Oilseed Section, SURDD

16. Panel Discussion on Processing and Product Quality.

H. D. Fincher, Moderator, Anderson, Clayton & Co., Houston, Texas
James Hickey, Armour & Co., Forrest City, Arkansas
John Howard, Southern Cotton Oil Co., Cullman, Alabama
J. B. Perry, Jr., Mississippi Cottonseed Products Co., Grenada, Miss.
P. A. Williams, Southern Cotton Oil Co., New Orleans, Louisiana
A. M. Altschul, Southern Utilization Research and Development Division
V. L. Frampton, Oilseed Section, SURDD

17. Report of Resolution Committee.

18. Resume' and Announcements.

19. Adjournment.

Luncheon - Laboratory

Afternoon: Tour of Laboratory and visits with SURDD personnel.

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PRESS RELEASE

(This press release of the Conference was furnished on February 6, 1957, to various trade and technical journals and organizations, to the New Orleans newspapers and to a news bureau.)

Rapidly changing conditions in the oilseed processing industry, and the necessity for continual alertness to meet these changes, was the keynote of the Sixth Cottonseed Processing Clinic held at the Southern Regional Research Laboratory in New Orleans, La., February 4-5. The conference, sponsored jointly by the Valley Oilseed Processors' Association, Inc., and the Southern Utilization Research and Development Division of the Agricultural Research Service, USDA, was attended by 110 representatives of cotton oil mills, commercial laboratories, industrial organizations, and state and federal agencies, in addition to staff members of the Southern Utilization Research and Development Division.

Technological advances, which have brought about revolutionary changes in oil mill operations; changes in public tastes; competition from other oilseeds, such as soybeans, were among the major causes for new trends in the cottonseed processing industry.

Dr. C. H. Fisher, Director of the Southern Utilization Research and Development Division, welcomed the visitors, and Robert F. Patterson, Trenton Cotton Oil Co., Trenton, Tenn., president of the Association, responded. Dr. E. F. Pollard, SURDD, served as general chairman for the sessions the opening day, and Ralph Woodruff, research committee chairman, and Allen Smith, program chairman, both of VOPA, presided the second day.

In a discussion of new linters standards, in which participants were Marion Whitten, of the Agricultural Marketing Service; M. J. Fowler, Buckeye Cellulose Corp., and Thomas M. Gluyas, Mississippi Cottonseed Products Co., it was brought out that the new standards are intended to provide for the grading of linters as to color and other qualities, as well as staple. The general feeling appeared to be that the new standards had not been in force long enough for their practicability and general effect on the industry to be evaluated.

Progress in the development of improved cottonseed cleaning equipment was reported by L. L. Holzenthal of the Engineering and Development Section

of the Southern Utilization Research and Development Division; he described the use of rubber mats characterized as a "magic carpet", for more effective removal of sticks and similar debris following the separation of cottonseed by the ARS Differentiator.

The obligation of the cottonseed processing industry to produce high quality oils and meals was emphasized by E. A. Gastrock, of the Engineering and Development Section, SURDD, in his discussion of "Implications of Present Trends in the Industry on Processing Methods and Quality and Utilization of the Products." He mentioned the encroachments of other oils on the market formerly held by cottonseed oils and suggested that the latent qualities of cottonseed products, properly developed, would help these products in holding their economic position.

Surpluses of staple crop products, changes in dietary habits, increased production costs, and reduction in exports were cited by T. H. Hopper, of the Analytical, Physical-Chemical and Physics Section of SURDD, among the factors responsible for increased interest in the search for new crops. Crops which have been under study for some time include sesame, sunflower, and okra as edible oilseed crops; kenaf and ramie as fiber sources; guayule as a source for rubber, and safflower and castor beans as industrial oilseeds.

High protein meal came up for discussion during the program Monday afternoon. L. C. Roots, of Anderson, Clayton & Co., recounted some of his experiences in the production and marketing of cottonseed products in Mexico, and presented data as to the effect of such operations on tonnage, cake color, maintenance cost, oil yields, and power consumption in the press room.

Dr. Jack Milligan, of the Ralston Purina Co., had for his topic "Markets for High Protein Meal"; the feed manufacturing industry needs high quality, high protein concentrates particularly for use in rations for chickens, turkeys, and swine, and this offers an opportunity for properly processed cottonseed meal.

H. L. E. Vix and F. G. Dollear, both members of the staff of the Southern Utilization Research and Development Division, discussed research needs of the industry. Mr. Vix reviewed developments in research applicable to cottonseed processing and products at the SURDD, particularly with regard to engineering and control phases; Mr. Dollear gave most of his attention to the current program of research on cottonseed oil and a discussion of future investigations. He mentioned possible new uses of cottonseed oil such as industrial uses as a basis for lubricants and plasticizers, and described present work on cottonseed oil as a confectioner's coating, the acetoglycerides and polymeric fats.

Refining losses, color, and keeping quality were emphasized by Porter A. Williams, Southern Cotton Oil Co., and H. D. Fincher, Anderson, Clayton & Co., during a discussion on oil quality as factors needing attention. The trend in industry has been toward lighter finished oils and shortenings for a number of years; cottonseed processors are endeavoring to improve cottonseed oil through improved processing methods. Mr. Fincher, who served as moderator for a panel discussion of processing and product quality, cited protein solubility, free and total gossypol content, and appearance as important factors in meal quality; improved processing methods should bring about increased protein solubility and better appearance. He suggested that chemical treatment may be necessary to reduce the gossypol content to levels desirable for poultry and swine feeding.

P. H. Eaves, Engineering and Development Section, SURDD, reported on comparative yields of crude and neutral oils from variously prepared cottonseed meats.

The Tuesday morning program was featured by a lively discussion of hidden oil losses by a panel moderated by W. G. Quinn, Buckeye Cotton Oil Co., and composed of Allen Smith, Perkins Oil Co., J. R. Mays, Barrow-Agee Laboratories, F. A. Norris, Swift & Co., J. H. Brawner, Southern Cotton Oil Co., and P. H. Eaves, of the Southern Utilization Research and Development Division. Mr. Mays said that in their investigation of such losses, it appears there may be more oil or fats in the meats than is indicated by usual analytical methods, and recommended basic research to obtain further information. Allen Smith, after presenting data from a number of mills for the 1954-55, and 1955-56 seasons, suggested that it might be advisable to strike a balance between failure to recover all of the oil indicated by analysis, and refining losses where the oil is more thoroughly extracted. It was the consensus of the panel, however, that such oil losses are a major problem, and should be the object of further study.

Dr. V. L. Frampton, of the Oilseed Section, SURDD, reported on the large-scale tests on the feeding of commercial cottonseed meals to broilers, a project being carried on cooperatively by the National Cottonseed Products Association, a number of industrial firms, and state and federal agencies.

He was followed by Dr. A. M. Altschul, also of the Oilseed Section, SURDD, who expressed considerable optimism for the future of cottonseed meal for feeding of poultry and swine, and read statements by committees on poultry and swine given at the recent conference on processing of cottonseed meal as related to nutritive value. He made the point that conditions of processing, particularly degree of heating, are major factors in producing cottonseed meals suitable for feeding to broilers and swine, and said that meals of acceptable quality are being produced by screw-press and prepress solvent extraction processes where the conditions are carefully controlled. He emphasized that a large potential market for cottonseed meal exists in the cotton-producing states, and expressed optimism that more of the market can be captured for cottonseed meal, and that in the future, through research and improved methods, cottonseed meal can be made suitable for feeding to laying hens, and to swine on a much larger scale.

These talks were followed by the panel discussion on processing and product quality.

Tuesday afternoon was given over to a tour of the Southern Regional Research Laboratory, and visits with members of the scientific staff.